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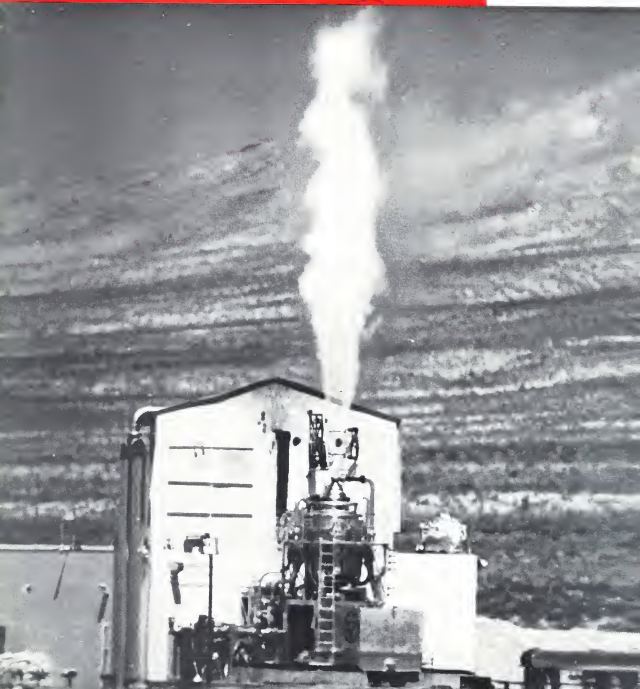
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Milson 1502-71	.375	4,600	5,000	975
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Jan. 1924—Seismic Control Meeting
Western Institute of Electrical Engi-
neers, Chaffee, Tilden Hall Bldg., Wash-
ington City, D. C.

June 22-24-1966 Conference on Materials and Electronic Microanalysis, NEBfields Laboratories, Boulder, Colo. Co-sponsors: Institute of Radio Engineers

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Radio Systems Laboratory, National Bu-
reau of Standards, American Institute of
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June 21-25—High Speed Meeting, held at
of Ningbo, U. S. for 1000 members

June 26-July 1, United World Shooting and
Archery Exhibit, American Society for
Living, Monterey, California (Hadden
Hall, Monterey, Cal. 93940)

June 25-26—Fourth National Convention on Military Electronics Institute of Radio Engineers, Sheraton Park Hotel, Washington, D. C.

June 28/July 1, Natural Sciences Meeting
Institute of the Anatomical Sciences
Anderson Hotel, Los Angeles, Calif.

July 14—Fourth Annual Fort Wayne National Championships (sprint, club)

July 5-15—Special Summer Program at the
 Great Lakes—1-800-426-1000 and 1-800-

plasma, Massachusetts Institute of Technology, Cambridge, Mass.
14. M. J. Glickman, in *Biophysics*, ed. by R. D. Brierly, Academic Press, New York, 1970, p. 117.

Strides Hotel Lanes Park Golf Open

see *Widdowson's South of the Tropic*
see *Index*, of *Myung Widdowson*
and *Editha L. L. L.*

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The President and Congress, by John Edgar Hoover, Director, Federal Bureau of Investigation, New York: The President and Congress of America, Inc., 1960. Pp. 187. \$1.50.

1. *Journal of American Studies*, 39 (1995), 1, 107-120, 107-108, 110-111, 113-114, 116-117, 119-120, 122-123, 125-126, 128-129, 131-132, 134-135, 137-138, 140-141, 143-144, 146-147, 149-150, 152-153, 155-156, 158-159, 161-162, 164-165, 167-168, 170-171, 173-174, 176-177, 179-180, 182-183, 185-186, 188-189, 191-192, 194-195, 197-198, 200-201, 203-204, 206-207, 209-210, 212-213, 215-216, 218-219, 221-222, 224-225, 227-228, 230-231, 233-234, 236-237, 239-240, 242-243, 245-246, 248-249, 251-252, 254-255, 257-258, 260-261, 263-264, 266-267, 269-270, 272-273, 275-276, 278-279, 281-282, 284-285, 287-288, 290-291, 293-294, 296-297, 299-300, 302-303, 305-306, 308-309, 311-312, 314-315, 317-318, 320-321, 323-324, 326-327, 329-330, 332-333, 335-336, 338-339, 341-342, 344-345, 347-348, 350-351, 353-354, 356-357, 359-360, 362-363, 365-366, 368-369, 371-372, 374-375, 377-378, 380-381, 383-384, 386-387, 389-390, 392-393, 395-396, 398-399, 401-402, 404-405, 407-408, 410-411, 413-414, 416-417, 419-420, 422-423, 425-426, 428-429, 431-432, 434-435, 437-438, 440-441, 443-444, 446-447, 449-450, 452-453, 455-456, 458-459, 461-462, 464-465, 467-468, 470-471, 473-474, 476-477, 479-480, 482-483, 485-486, 488-489, 491-492, 494-495, 497-498, 500-501, 503-504, 506-507, 509-510, 512-513, 515-516, 518-519, 521-522, 524-525, 527-528, 530-531, 533-534, 536-537, 539-540, 542-543, 545-546, 548-549, 551-552, 554-555, 557-558, 560-561, 563-564, 566-567, 569-570, 572-573, 575-576, 578-579, 581-582, 584-585, 587-588, 590-591, 593-594, 596-597, 599-600, 602-603, 605-606, 608-609, 611-612, 614-615, 617-618, 620-621, 623-624, 626-627, 629-630, 632-633, 635-636, 638-639, 641-642, 644-645, 647-648, 650-651, 653-654, 656-657, 659-660, 662-663, 665-666, 668-669, 671-672, 674-675, 677-678, 680-681, 683-684, 686-687, 689-690, 692-693, 695-696, 698-699, 701-702, 704-705, 707-708, 710-711, 713-714, 716-717, 719-720, 722-723, 725-726, 728-729, 731-732, 734-735, 737-738, 740-741, 743-744, 746-747, 749-750, 752-753, 755-756, 758-759, 761-762, 764-765, 767-768, 770-771, 773-774, 776-777, 779-780, 782-783, 785-786, 788-789, 791-792, 794-795, 797-798, 800-801, 803-804, 806-807, 809-810, 812-813, 815-816, 818-819, 821-822, 824-825, 827-828, 830-831, 833-834, 836-837, 839-840, 842-843, 845-846, 848-849, 851-852, 854-855, 857-858, 860-861, 863-864, 866-867, 869-870, 872-873, 875-876, 878-879, 881-882, 884-885, 887-888, 890-891, 893-894, 896-897, 899-900, 902-903, 905-906, 908-909, 911-912, 914-915, 917-918, 920-921, 923-924, 926-927, 929-930, 932-933, 935-936, 938-939, 941-942, 944-945, 947-948, 950-951, 953-954, 956-957, 959-960, 962-963, 965-966, 968-969, 971-972, 974-975, 977-978, 980-981, 983-984, 986-987, 989-990, 992-993, 995-996, 998-999, 1001-1002, 1004-1005, 1007-1008, 1010-1011, 1013-1014, 1016-1017, 1019-1020, 1022-1023, 1025-1026, 1028-1029, 1031-1032, 1034-1035, 1037-1038, 1040-1041, 1043-1044, 1046-1047, 1049-1050, 1052-1053, 1055-1056, 1058-1059, 1061-1062, 1064-1065, 1067-1068, 1070-1071, 1073-1074, 1076-1077, 1079-1080, 1082-1083, 1085-1086, 1088-1089, 1091-1092, 1094-1095, 1097-1098, 1100-1101, 1103-1104, 1106-1107, 1109-1110, 1112-1113, 1115-1116, 1118-1119, 1121-1122, 1124-1125, 1127-1128, 1130-1131, 1133-1134, 1136-1137, 1139-1140, 1142-1143, 1145-1146, 1148-1149, 1151-1152, 1154-1155, 1157-1158, 1160-1161, 1163-1164, 1166-1167, 1169-1170, 1172-1173, 1175-1176, 1178-1179, 1181-1182, 1184-1185, 1187-1188, 1190-1191, 1193-1194, 1196-1197, 1199-1200, 1202-1203, 1205-1206, 1208-1209, 1211-1212, 1214-1215, 1217-1218, 1220-1221, 1223-1224, 1226-1227, 1229-1230, 1232-1233, 1235-1236, 1238-1239, 1241-1242, 1244-1245, 1247-1248, 1250-1251, 1253-1254, 1256-1257, 1259-1260, 1262-1263, 1265-1266, 1268-1269, 1271-1272, 1274-1275, 1277-1278, 1280-1281, 1283-1284, 1286-1287, 1289-1290, 1292-1293, 1295-1296, 1298-1299, 1301-1302, 1304-1305, 1307-1308, 1310-1311, 1313-1314, 1316-1317, 1319-1320, 1322-1323, 1325-1326, 1328-1329, 1331-1332, 1334-1335, 1337-1338, 1340-1341, 1343-1344, 1346-1347, 1349-1350, 1352-1353, 1355-1356, 1358-1359, 1361-1362, 1364-1365, 1367-1368, 1370-1371, 1373-1374, 137

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On 19 July 2002, the first of these reports was received from the Ministry of Health, indicating that a patient had died from a severe allergic reaction to a vaccine. The patient was a 10-year-old girl who had been vaccinated against measles, mumps and rubella (MMR) on 15 July 2002. She had no other medical history and was otherwise healthy. The patient's mother reported that her daughter had been vaccinated against MMR on 15 July 2002 and had been well until the day of the vaccination. She reported that her daughter had been vaccinated against MMR on 15 July 2002 and had been well until the day of the vaccination. She reported that her daughter had been vaccinated against MMR on 15 July 2002 and had been well until the day of the vaccination.

Keywords: book recommendations, social status, *U. stans*

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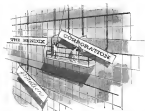
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EDITORIAL

Military vs. Civil Space Requirements

When the United States belatedly developed a national requirement for a space exploration program, the decision was made to entrust this task to a civilian agency. Subsequently an Administration policy developed to scoff at the potential military uses of space technology and to stress the "peaceful" uses of space along with international scientific cooperation in space exploration.

It has become evident as space technology progressed that the most immediately effective use of space for generally peaceful purposes lies in the development of satellite reconnaissance and communication systems that will make surprise attack by a potential aggressor with ballistic missiles extremely difficult. Removing the element of surprise from an ICBM attack obviously subtracts one of its most potent military assets.

It has also become evident that the development of an operationally reliable reconnaissance and communication satellite system must tread a narrow, development, design and production road that diverges sharply from the requirements of purely scientific exploration of space.

It is this sharp difference between the requirements of an operationally reliable military satellite system and scientific space probes that is becoming increasingly obvious as the primary space technology requirements continue to be formulated from the scientific rather than the military viewpoint.

Military System Needs

First, a military space system must have a high degree of agency spurring its development to become operationally effective in time to produce the required results. It must also have a far broader outlook in its design, development and production, aiming at a completely operational system, logistically supportable and capable of being manned with average rather than highly skilled scientific personnel. It must be designed not only for continuous operational reliability but also for a price that will fit into the national budget structure.

The biggest problem of a military space system is operational reliability. It must embody not just one or two spare satellites but a complete system of satellites going continuous, reliable global coverage and equipped with payloads that can function 24 hr a day for periods up to six months or a year. Any malfunction of these satellite systems must be capable of quick repair by a swift replacement with the precise launch and orbit required to fill the exact gap in the system. This requires a capability for more extensive and advanced than that necessary for scientific space probes.

A military space system requires substantial tracking facilities to monitor the steady function of the satellites and their payloads. It also requires the specific continuous data reduction and transmission that the most

advanced electronic computer techniques can provide. Swift warning of an enemy's aggressive action would serve no useful purpose if its data reduction and transmission did not reach responsible sources until after the first missile strike.

Booster Requirements

The requirement for relatively large quantities of military satellite boosters in comparison with those needed in scientific ventures and the requirement for short notice launching to replace defective satellites in the system both point in the direction of a cheaper, more easily producible and more reliable booster than is now being developed for space exploration. Recovery of these boosters will also probably be dictated in the interests of reasonable costs.

Military space systems, once their research and development phase is past, will probably be larger and more complex in operation than the current liquid fueled ballistic missile arsenal. Consequently, it will not be possible to develop all possible types of space systems at once with any degree of technical, financial or military flexibility.

What is needed now is a thorough re-examination of the military role in space with a view toward what it can contribute to the preservation of world peace in the immediate future through the reconnaissance and communication satellite systems. This should be followed closely by some immediate, selective decisions establishing top priority and a policy of concurrency in proceeding with both research and development and the other efforts required to produce all the elements of an operational system at the same time. While this is going on, it should be possible to take a longer look at what the next generation of military space possibilities can offer and begin to lay a solid foundation of research and development in that direction.

Space Potential

Sooner or later the nation must face the fact that there are basic technical and operational differences involved in the development of space boosters, vehicles and techniques for the scientific exploration of space and of those aimed at actual military requirements. Few people would take issue with the argument of the scientific space exploration role to NASA.

But it is becoming increasingly evident that as the political emphasis on the civilian aspects of the program and its direction we are not recognizing the full military potential to be realized in the vastness of the future from space technology. We are, in fact, just beginning to recognize that it is a far, far different road we must travel to reach this goal as opposed to the achievable but distinctly different goal of scientific exploration of space.

—Robert Hertz



RECONNAISSANCE, THE LACK OF IT, AND A FAULTY COMMAND DECISION

The year is 1862. The Army of the Potomac, 70,000 men in all, is pinned to do battle. Facing them, General John B. Magruder's divisions of the Confederate Army of Northern Virginia finally stretched before Richmond, but numbering only 15,000. The sheer weight of Federal men and equipment apparently is sufficient to gain the victory, destroy the Southern force, capture the Confederate capital and perhaps end the war.

But General George B. McClellan, the Union Commander, never orders the advance. Why?

During the years preceding the war, adequate provisions for reconnaissance had not been made. McClellan's intelligence, derived by the famous detective Allan Pinkerton, underestimated the strength of the Confederate forces . . . overestimated their forces to be twice those of

the Army of the Potomac. During this early phase of the War, Union reconnaissance was not incorporated and limited in number to verify the civilian intelligence. And so this singular Union opportunity slowly ebbs—drenching into three more years of bloody warfare . . . the result of a faulty command decision.

From the beginnings of command on the face of the earth, reconnaissance has formed shape history. Today CAs a specialty in this area is helping shape history to the advantage of the Free World. Types of CA reconnaissance are: V.I.P., Visual Integrated Presentation, data display systems, RA-3B, the world's most sensitive aerial camera; BG-60, the only inter-aircraft "variable stare" guidance system.



CHICAGO AERIAL INDUSTRIES, INC.

186 HAWTHORNE MILROSE PARK, ELK GROVE • OFFICE DAYTON LOS ANGELES, WASHINGTON, D.C.

OTHER DIVISIONS: KRYPTONIC CHICAGO AERIAL SURVEY, FAYETTE PA., OHIO, PHOTO OPTICAL CORP., SPRINGFIELD, ILL.

WHO'S WHERE

In the Front Office

Robert R. Addison, executive vice president, United Technology Corp., Palo Alto, Calif., a subsidiary of Hughes Aircraft Corp. Mr. Addison continues as director of the Operations Division. Also Norman V. Turner, vice president, has joined treasurer.

Yusef Kibria, a director and general manager, TeM Aerospace Co., Ltd., Ottawa, Can.

Charles Wright Corp., Wood Ridge, N.J., has retained Quinn Lanning as consultant to evaluate the technical approach and feasibility of the company's tentative and tentative VTOL model airplane.

Kenneth H. Kipatnik, a director, Division for Mission III, N.J. Mr. Kipatnik is executive vice president of Science Research Co.

N. J. Heller and **R. F. Winters**, directors, Tech Corp., Ashburn, Calif. Mr. Winters is Tech's director of manufacturing. Mr. Heller is president and research director of Heller Research Foundation.

Edward J. Hinton, vice president, Duane Systems Co., Concord, Calif.

Pacific Reconnaissance, Inc., Colton, Calif., a subsidiary of Thompson Radio Wrecking, Inc., has elected the following as vice president: **Lawrence T. Lindgren**, for manufacturing; **Dr. John W. Peterson**, for research and development; **Robert L. Spiegel**, for marketing.

R. D. Karswell, vice president and director of marketing and a director, U. S. Science Corp., Los Angeles, Calif., a division of United Industrial Corp.

Harvey P. Lewis, vice president and treasurer, Transient Electronics Corp., El Segundo, Calif.

Levin Falk, Jr., vice president of operations, the Sheffield Corp., Dayton, Ohio, a subsidiary of The Bendix Corp.

John H. Richardson, vice president, now being, Hughes Aircraft Co., Colton, Calif.

Freeman S. Stone, vice president, Atlantic Research Corp., Alexandria, Va.

Robert F. Winters, a group officer and vice president, U. S. Industries, Inc., New York, N.Y.

Thomas G. Wolfe, Jr., deputy assistant secretary of defense (intelligence and logistics) Department of Defense, Washington, D.C. according to James F. Foley, resigned.

Members and Elections

1. Belding Davis, vice president of Gas and Electric Co. and general manager of CEI electronic components Division, has been elected president of the Electronic Industries Assn., Washington, D.C., succeeding **Donald R. Bull**, a vice president of Kerm Co.

Gregory L. DeVotie, Chicago's executive director of public works, has been elected president of the Airport Operators Council of surrounding J. R. Wiley, section director of the Port of New York Authority.

J. J. McClellan, manager of quality control at the Ford Motor plant at Conner Division of Chrysler-Dodge Corp., has been elected president of the American Society for Quality Control.

(Continued on page 124)

INDUSTRY OBSERVER

► **Charles Wright's** proposal for the Siliem engine concept entails cells for a wingless configuration 10 to 50 ft. long and 10 ft. in outer diameter, with some steps for aerodynamic control. Raster diameter is expected to be approximately 5 ft.

► **Republic RF-107** has been proposed as an interim Royal Air Force reconnaissance aircraft for use until the English Electric-Viscount TSR 2 tactical strike-reconnaissance aircraft is operational.

► **Chicago Aerial Industries** has developed a compact aerial camera for low-level, high-speed photo reconnaissance missions. It uses a 4.5-in. square format instead of the current 8-in. square, and has a coating rate up to 100 exposures per second. Film is processed in flight at about 100 ft. per second, a result for interpretation immediately on return of a one-man aircraft from mission, or for interpretation during mission in the case of undifferentiated aircraft.

► New configuration of USAF-Douglas GAM-77A Skybolt air-launched ballistic missile eliminates ground controls, uses fixed nose and movable fins for first stage control; movable nozzles for second stage. Propulsion system also has undergone design changes. Missile, aircraft and other system components have been given the weapons system designation WS-433A.

► Second attempt to put a 100-ft. Echo reconnaissance sphere into orbit, originally scheduled for next May from Pacific Missile Range, now may be substituted for the firm III reconnaissance satellite launching that has been scheduled for August from Atlantic Missile Range. First launching of Echo, using a Thor-Atlas, which was under the Thor-Delta, was a success. First launching of Echo, using the first Thor-Delta vehicle, was a failure. Third launching of an Echo reconnaissance satellite was scheduled for January, 1962, under the original Delta timetable.

► At Propulsion Laboratory's work on Ariane missile program, including Segment and Corridor, is expected to be phased out after July 1. This will leave the laboratory, which is operated by California Institute of Technology for National Aeronautics and Space Administration, free to give full time to spacecraft and small amount of remaining space propulsion work.

► NASA plans to make public the frequencies to be utilized from satellites and the transmitting codes being used in future launches whenever other observers around the world can actually participate in experiments. Information will be distributed through the National Academy of Sciences and the Committee on Space Research (COSPAR) of the International Council of Scientific Unions.

► Air Force Ballistic Missile Division is giving increasing consideration to use of "aircraft" with control for communication between Minuteman intercontinental ballistic missile and control centers and command posts (AWM May 15, 1959, p. 20). Relative vulnerability in system's most critical phase.

► JPL's Ranger space vehicle will have radio communication for midcourse guidance correction on lunar flights. Reaction jets will furnish attitude control needed for the solar panel power supply and the directional antennas that will be used for earth-orbit communications.

► Changes under consideration in the continuing reorganization of Air Research and Development Command include phasing Hollywood, Calif., regional office under Ballistic Missile Division, the New York office under Command and Control Development Division and the Chicago regional office under Wright Air Development Division.

► Congressman Chace claims it is doubling the number of agricultural aircraft in use this year over last year. The Civil Aviation Administration has said an equal to 11 projects in control, and said agricultural Chace state March to speak for wheat rain.

Why Offset Paper Masters by Xerography?

What's xerography?

A dry, clean, fast, electrostatic copying process that economically reproduces offset paper masters for duplicating. You can enlarge, reduce, or copy size to size. Original may be anything written, printed, typed, or drawn. Equipment used is called Xerox® copying equipment, made by Haloid Xerox Inc.

Is Xerox copying equipment easy to operate?

Yes. These simple steps: separate, dry, process, and dry transfer. Within a few minutes anyone can learn the operation. No original is too hard to handle. There are no critical exposures or temperatures, therefore, waste of materials from wrong exposures is negligible—almost impossible.

How about quality?

Superb. Often it's hard to tell copies from the original. That's why many office-service and engineering-reproduction departments use Xerox copying equipment exclusively for the preparation daily of hundreds of offset paper masters.

Can a copy ever be better than the original?

Yes. Copies of day-worn and cracked engineering drawings, carbons of bills of lading look far better than the originals when the masters are prepared by xerography.

What about costs?

Costs are remarkably low. There are many reasons: xerographic materials cost only a few pennies per master. No special offset paper masters are required and none are wasted. Operator's time is lower because there are no critical adjustments for exposures. The more you need offset paper masters, the more you'll save by xerography over any other method.

Need not chemicals?

None whatever. No pool agent either. And, of

course, there's no changing of chemicals—no "RIP" for an office girl at today's higher salaries.

How about length of run?

You get much longer runs from masters prepared by xerography. Because of their durability, xerographic masters do not break down from wet chemicals, thus last longer, and produce much longer runs—5,000 and 10,000 copies are not uncommon.

Do masters have to be "hardened" after preparation by xerography?

No. They are ready immediately for the duplicator and, unlike photographically prepared masters, they don't require reentering for pre-work film in if the machine stops during the run.

Any need of a darkroom?

None. Xerox copying equipment is operated in full daylight.

Will Xerox copying equipment make other types of duplicating masters?

Yes, xerography is the world's most versatile copying process. Xerox copying equipment also prepares transparencies for slide-type duplicators, spirit masters for spirit duplicators, and metallic masters for offset duplicators.

Who uses xerography?

Most of the best known companies in America and Canada—and nearly all government agencies when duplicating is required.

Where can I find out more about xerography and offset duplicating?

Write today for our Xerox copying equipment brochure. It shows you how to spend your money duplicating and save thousands of dollars yearly by xerography. Haloid Xerox Inc., 400-8th St., Haloid, N.Y. Branch offices in principal U.S. and Canadian cities. General: Xerox-Xerox Ltd., London.

**HALOID
XEROX®**

Missiles for Britain

Washington Roundup

Britain plan to use both the Skybolt and Polaris missiles on delivery systems for its own thermonuclear warheads. Details of the plan were discussed in Washington last week during the visit of Defense Minister Harold Wilson.

Wilson will coordinate both security and technical personnel to the Skybolt research and development effort. The Douglas air-launched ballistic missile is expected to go into operation on part of the RAF's Bomber Command Victor and Vulcan fleet in 1965. RAF will fly V bombers to the U.S. for operational tests of Skybolt at Eglin AFB.

Royal Air Force will use the underpowered Vulcan Blue Steel Mark I air-to-ground missile (see p. 16) on its Victor and Vulcan bombers and Skybolt in reach.

Polaris missiles are expected to go into submarine service with the Royal Navy in the 1967-68 period. U.S. will provide technical assistance to Britain for its own Polaris submarine building program. Any earlier British use of Polaris would depend on U.S. supplying the North Atlantic Treaty Organization with a usable, land-based Polaris system.

Britain plan to use their own thermonuclear warheads on both the Skybolt and Polaris missiles.

Discontent over promotion policies may hurt the Air Force more of its electronics officers. Many officers reaching their 20 year retirement ceiling are unhappy over the policy of selecting general officers almost entirely from staff flying officers. This unhappy group is developing a new ideas USAF need for electronics specialists in growing.

Airframe companies have caught wind of the mounting discontent. They are actively recruiting colonels and lieutenant colonels with electronics backgrounds who are approaching retirement eligibility.

Nuclear aircraft program is under study by an ad hoc committee of the Air Force Scientific Advisory Board. Study will be launched with a June 15 visit to Pratt & Whitney in Hartford, Conn. Group is headed by Ernest Fieser, chairman of the board's nuclear panel.

SAGE Rescue Effort

Efforts to use land-based SAGE super-control centers from the budget are pegged to the requirement that the system could double its government command post in a nuclear attack. Funds for eight of the underground centers were cut from the Fiscal 1961 budget. Supporters say one set of the super-control centers, equipped with an AN/TSG-7A digital computer, communications and display facilities, could be used to conduct the nation's military operations if other centers were destroyed in a nuclear attack.

Department of Associate Administrator Richard E. Horne from NASA at the end of the month will mark the first in a series of changes in top echelon that will cover over the next half year.

Administrator T. Keith Glennan is expected to stay in office until President Eisenhower leaves the White House in January. It is doubtful that he will stay beyond that point unless the new President makes a strong plea for his services.

James H. Stewart, head of the NASA Office of Program Planning and Evaluation, set a two year limit when he accepted the job. He is expected to leave NASA headquarters long next fall to return to California Institute of Technology's Jet Propulsion Laboratory.

Air Force Col. Charles H. Roodman will join National Aeronautics and Space Administration soon as a special assistant to Clark Randt, director of the Office of Life Sciences programs. Roodman currently is chief of the human factors branch under the Deputy Chief of Staff for Development in USAF headquarters.

Wrapup

Senate Appropriations Subcommittee on the Armed Services meets this week to vote on version of the Fiscal 1961 defense budget. Defense Department is scheduled to have a report on the annual nuclear program program, prepared by House Appropriations Committee, completed by October. Legislation establishing an Office of International Trade and Finance has been approved by the Senate Commerce Committee and stands a good chance of enactment this session.

Defense Department has scheduled the annual Quarterly meeting of its top level civilian and military officials for June 16-17. About 160 officials will discuss matters of common interest, exchange ideas regarding the current state of the defense program. Glennan is expected to debate proposed changes in the National Space Act this week. Changes in patent policy will be the most controversial issue.

—Washington Staff

Soviets Boast of Impregnable Defenses

Washington — Central Intelligence Agency does not "have a plane with a ceiling that could not be reached by our rockets," Soviet Defense Minister Marshal Rodion Y. Malinovsky said last night.

In a Moscow speech, Malinovsky also backed up earlier warnings by Soviet Premier Nikita Khrushchev to countries that might allow U. S. aircraft to use their bases for flights over Russia or over the other Communist territory.

Malinovsky told a conversation of Soviet " shock workers " that he had given orders to his chief of rocket forces Marshal M. I. Nudelin, no state or sea base from which a plane might fly to violate the territory of the Soviet Union or the socialist countries.

Russia has modern missile means " to deterrence quite passively when the plane flies from to watch over its flight and to deterrence when it lands " the defense minister said. " This means that no one can sit arrange to escape responsibility."

The action (refutation against base) would be fully justified," Malinovsky said, "because we do not know that the intruder plane may carry. It may well be a hydrogen bomb."

Soviet Defense Strength

Malinovsky took exception to Western statements that Boris of Lashkov U-2 reconnaissance planes had proved that Soviet defenses were weak and that Russian anti-aircraft rockets could not reach above 60,000 ft.

All of these unsuccessful attempts, he said, depend on our antiaircraft defenses and at the same time to reduce faith in the invulnerability of the Lockheed U-2 are very important to control space via U-2 pilot Francis Powers. (The constant use)

"Perhaps the problems from the agency of Allen Dulles (Central Intelligence Agency) really do not know the confidence in the Soviet command forces of an anti-aircraft potential as I will tell them."

"Confidence, we have such rockets and we have wonderful rocket men. Our rockets are able to hit targets not only at an altitude of 38,000 meters (about 60,000 ft.) but much higher," Malinovsky said.

In short, you do not like a plane with a ceiling that could not be reached by our rockets. As you are confident, sometimes we find it possible to bring some of our rockets into the area."

Two days earlier, Khrushchev told the same group that Soviet defenses were had been weaker. He said he had known of past flights and added:

"Now they say that the Soviet Union showed its weakness meaning that in the past we could not bring down their planes. Yes, such a situation existed. Our fighters climbed that high but they couldn't find the approach planes and strike at them," Khrushchev said.

In those days the government told its scientists, engineers and artists that the way was to be fixed and our ships should be more close of many planes. [They] did a good job to fulfill this assignment. They made up today, so in any, and produced even developed missile technology. And now it is the American airplanes themselves who give us the chance of downing starting the full effectiveness of their missile technology."

Khrushchev repeated his claim that the first missile downed the U-2 at 30,000 meters altitude, and said: "That

New Soviet U-2 Story

Moscow-Soviet news claims that the Lockheed U-2 last seen Sunday was made of titanium and as a result is stronger than is light that it failed to reach from an altitude of over 60,000 ft. and landed without disintegrating completely.

The latest Russian explanation for the relatively good condition of the U-2 structure was explained on exhibit as Golda Park yesterday also that the aircraft was not hit directly by a rocket but was sprayed by shrapnel from a weapon that exploded nearby.

Two previous accounts of the downing of the U-2 have been given by the Soviets. Premier Khrushchev said initially that the aircraft had been hit by a "remarkable" rocket. The description of the firing of this rocket given by Rodion Y. Malinovsky, however, stated that the U-2 exploded when it was hit. First Russian pictures of the U-2 "wreckage" showed it as a rocket that was almost completely disintegrated. These pictures were declared by U. S. experts to be false, and they have no resemblance to the U-2 wreckage later exhibited in Moscow.

Second version of the U-2 interception and downing was contained in the display of wreckage. It said that the rocket had hit the U-2 in its Pratt & Whitney JTF 35 engine, and that this had prevented the pilot from being rescued.

Examination of the U-2 wreckage in Golda Park indicates that the pilot, Francis G. Powers, made an emergency bailout leading to the aircraft (AW May 20 p. 12).

was the last day my planes could be sent into our skies with impunity."

U. S. "militants" now are warned "because their entire military concept of attack on the Soviet Union, based on the use of bombers, crashed away," Khrushchev said. "Indeed, modern bombers do not fly higher than 12,000 to 15,000 meters."

"This means we shall certainly not let any bomber get through to its target."

Any of them will be shot down either by missiles or by fighters or by anti-aircraft guns which shoot that high today," Khrushchev said.

Rocket Production

Russia has "stopped production of some kinds of rockets and also down production of other kinds," Khrushchev said. "Rockets are not necessities. We can't eat them. You need only a certain number for defense."

In other developments resulting from the U-2 incident:

• Soviet Foreign Minister Andrei Gromyko, who presented Russia's accusations concerning United Nations Security Council condemnation of the U. S. for the May 1 flight of a U-2 over his country, said in New York as he departed for Moscow that Soviet armed forces have "a simple reply" for those "who like to rush into our house for such information—out of our heads."

• Moscow's Foreign Minister Nikolai Lozko told his parliament that no permit for reconnaissance flights be allowed would be issued without special approval of the government. No permit have been given since May 1, he said.

Defense Minister Nikita Khrushchev said a U-2 landed at Bodo, its field where pilot Powers was reportedly bailed out on May 1, in the summer or fall of 1958. Powers himself was in that area at about the same time, Khrushchev said. He and there is no reason to believe "the 1958 flight was a question of anything but a normal flight," and he said it landed after normal clearance.

Khrushchev said in a statement published in the government newspaper Pravda that he had been prepared to meet with President Eisenhower privately in Paris before the summer conference, and that statements by Khrushchev and U. S. Secretary of State, Christian Herter to the contrary "are manifestly false" partly because of the U-2 flight, the initiative for such a meeting was up to the U. S., but Khrushchev did not take that initiative, Khrushchev said.



Shocking down configuration and aerial view of the F-1 1.5 million lb. thrust rocket engine being developed by Rocketdyne Division of North American Aviation for National Aeronautics and Space Administration. Initial full-thrust firing of a complete F-1 engine are expected to begin next spring at the Rocket Engine Test Station at Edwards AFB, Calif. (AW May 21, p. 12)

F-1 to Be Tested at 1.5 Million lb. Thrust in Spring

Shocking down configuration and aerial view of the F-1 1.5 million lb. thrust rocket engine being developed by Rocketdyne Division of North American Aviation for National Aeronautics and Space Administration. Initial full-thrust firing of a complete F-1 engine are expected to begin next spring at the Rocket Engine Test Station at Edwards AFB, Calif. (AW May 21, p. 12)



USAF Study Group Report Due On Electronic Support Systems

Bolton, Mass.—Report of the Air Force's Winter Study Group, which may recommend augmentation of some of USAF's large electronic support systems, is scheduled for July.

Winter Study Group also is to recommend specific technical areas in the fields of automatic data processing, data sources, display and communications, which require developmental effort to meet Air Force needs in the 1955-70 period.

Electronic Needs

The Winter Study Group has formed six working groups to analyze the Air Force's projected needs for electronic support systems in the 1955-70 period and to determine whether there are sufficient duplications in the existing working situation at each system which Air Force has proposed. This list includes the Strategic Air Command Control System (SACS), Air Force Control System (AFCS), Intelligence Data Handling System (IDS), Electronic Intelligence System (460 L) (JAW, May 7, p. 25).

Under its charter, the Winter Study Group is authorized to determine what

intelligence, command and control functions are required by USAF Headquarters, theater commands and the Strategic Air Defense and Tactical Air Commands, then recommend the best way to meet these needs with minimum investment and duplication.

Headed by Gordon N. Thayer of American Telephone & Telegraph Corp., with Let Col. John L. Lombardo, USAF Command and Control Division, and John F. Jacobs, Nike Corp., as executive director, the group now has 119 full-time members. Majority of the personnel are drawn from Air Force centers, Lincoln Laboratories, and Nike Corp., with a few technical experts on loan from industry.

In addition to three systems design panels which are analyzing new requirements, the Winter Study Group has established 13 specialty panels. Each of these specialty panels is studying a specific technical area or factor to determine whether the state-of-the-art can meet the demands of the proposed systems by 1955 and to propose specific areas which need more development effort.

Panel Subjects

Specialty panels now encompass data processing, among equipment (such as radar, infrared), communications equipment, human factors, display, computer logic, computer, logistics, cost, vehicle analysis, design methodology, weapons, status of the direct, and special studies.

Each of the four systems design panels, after detailed study with user commands, will come up with its own recommendations. Studies groups which will be completed with the design approach being employed in support systems now under development to direct users whether the best approach is being used.

The four systems design panels are slated to present their recommendations to USAF Headquarters and the operating commands in oral presentations later this month to get their reactions and ideas before setting final panel reports.

Each of the 13 specialty panels is expected to state its own report, indicating areas where the state-of-the-art is not sufficiently advanced to enable proposed systems to become operational and effective in the 1955-70 time period. Each panel also will recommend specific research and development effort which it believes the Air Research and Development Command should fund to advance the state-of-the-art required for support systems.

Reports by the 13 specialty panels may be placed by industry before the reports by the four systems design panels, according to present plans, so industry can learn where it should direct its research and development effort.

British, French Weigh VTOL Collaboration

London—Britain has agreed in principle to promote collaboration with France on VTOL aircraft, Minister of Aviation Duncan Sandys said in Parliament.

The Hawker P1127 is designed to meet a possible military requirement and is, therefore, attracting great attention," and Sandys, but the potential of the Hawk SC1, an also being greatly studied, although it is a purely practical use of this aircraft, we shall send a new design of the Hawk itself and a new engine."

A Ministry of Aviation spokesman said talks between British, French and German had taken place only at the ministerial level so far, but would say shortly be continued by technical representatives. He refused to comment on Sandys' implication that Hawker P1127, technology obtained from the P1127 would be shared with the French, as soon as any agreement is signed.

Soviet Space Cabin Operates in New Orbit

Washington—Parasolized orbit of Sputnik IV, which went into a higher orbit than its original one when an attempt to reenter it failed (JAW, May 30, p. 75), was still maintaining conditions suitable for supporting human life last week, according to Russian statements.

U. S. stations now are tracking tight

Earth Current Networks

Being Applied Co. is conducting tests now that will, on one of our earth current systems, connect communication networks. Concept involves transmission of subsonic electromagnetic waves for "sensing" measurements between control points. Extensive in personnel work in the field already has been done by Space Electronics Corp., Glenlake, Calif. (JAW, May 13, 1955, p. 18). Some of the work being done is a 300,000-watt earth current. Research Development Center for experiments and development in field of long range communication using earth current.

The new network deals with longer ranges than previous work.

measure in orbit in addition to the final stage of the launching rocket. The probe takes 31.50 sec to pass over a single tracking station.

Revised V. Probe tests in forests that "an orbital" before named space flight is attempted in a continuous and thorough surveillance of all functions of aircraft coming back to earth after a long stay on orbital facilities. Other statements and control of spacecraft may also be perfected.

Following is orbital information on the probe now in orbit, according to National Space Surveillance Council Center. Mission 1, the target of the right test, are traveling roughly in a group and the only probe that is having orbiting side again is assumed to be the presumed value. Epsilon 18 is the rocket body, still in approximately its original orbit.

Epsilon V last week was leading the group of eight probes.

Epsilon 18—apogee 415 mi., perigee 311 mi., period 94.1 min. Epsilon 11—apogee 155, perigee 118, period 90. Epsilon 11-3—apogee 414, perigee 372, period 94.3. Epsilon IV—apogee 426, perigee 178, period 94.1. Epsilon V—apogee 440, perigee 174, period 94.4. Epsilon VI—apogee 441, perigee 277, period 94.4. Epsilon VII—apogee 451, perigee 155, period 91.5. Epsilon VIII—apogee 412, perigee 188, period 91.5. Epsilon IX—apogee 435, perigee 177, period 94.5.

Suborbital Echo Shot Tests Radio Beacons

Washington—Tracking beacons are tested for the first time on a 100 ft suborbital sphere last week in a sub-orbital flight of the Project Echo communication satellite.

National Aeronautics and Space Administration launched the sphere from Wallops Station, Va., and the two-stage, solid propellant Scout Put launch vehicle located the sphere in an altitude of about 110 mi.

It flew about 540 mi. southwest across the Atlantic Ocean.

The 100 ft sphere, which was installed in flight, carried two beacons embedded in grid of Nylon plastic and connected to separate sides. Developed by Aero-Electronic Products Division of Radio Corp. of America, the beacons were 10 in. in diameter and 4 in. thick, and weighed 11 lb each. One became transmitted on 807.9 mc and the other on 387.97 mc. They had a power of about 5 milliwatts, and they were powered by solar cells which charged nickel cadmium batteries.

A small wind deflator was carried in a small quiver in each beacon, and the balloons inflated when the balloons inflated.

Midas Infrared Measurements Cut Short by Telemetry Failure

Washington—An Air Force Lockheed Midas infrared tracking satellite measurements in several different sections of the infrared spectrum during its first 16 earth orbits before its telemetry failed and made it impossible to complete the test program and reenter in ICBM firing with an orbiting infrared sensor.

After test objective with Midas II was not reached, data for infrared system to be used in operational satellites planned to warn of enemy ballistic missile attack.

Data returned by Midas II was obtained in several sections of the infrared spectrum by using a series of filters to adjust the amounts of its infrared sensor. Measurements of background infrared radiation from many types of heat sources on the earth by Midas II were scheduled to provide the monitoring of an Air Force Minute Time ICBM firing from Cape Canaveral, Fla. This developmental form of the Titan missile would, on an altitude, but the Midas II command data link was inoperative.

Another portion of the Midas II test program that was not completed was measurement of infrared radiation from large sodium flares. These flares were scheduled to have been based on the ground at Edwards AFB and Vandenberg AFB as the satellite passed overhead. They would have been visible 50 to 100 mi. in the desert and the flares have burned 45 sec. Sodium flares probably were scheduled in the test program to provide a source of infrared radiation of known intensity as the ground-to-satellite and back channel, the occupation in the Midas II satellite.

Much of the high altitude data on infrared radiation from the earth has been gathered by Lockheed U-2 aircraft operated by the Research and Development Command, such as Edwards AFB. These U-2s have been used to monitor ballistic missile flights from Cape Canaveral as well as to measure background infrared radiation in many areas. Midas II was intended to extend the detailed infrared data up to altitudes of about 100 mi. The satellite's orbit was almost circular, with a 322 mi. apogee and a perigee of 110 mi.

Schedule was written by the Lockheed Air second stage of the launch vehicle, which is an integral part of the Midas II satellite, fastened well and kept the infrared sensor properly oriented toward the earth during the first 16 orbits. USAF Command Atlas was the first stage booster for Midas.

Midas and Saturn launch complex



FIRST SUCCESSFUL Midas launching in infrared at Cape Canaveral. Command Atlas ICBM is launch, Lockheed Agon second stage carries infrared reconnaissance package.

at Naval Missile Facility, Ft. Belvoir, Calif. has been completed and turned over to RAND. The Pacific Missile Range launch complex consists of two Atlas pads, with girders, a blockhouse and ground support facilities. The 56 missile satellites were built by Wyle, Rent, Inc., prime contractor to Navy Bureau of Aids and Deeds.

Chance Vought to Build Airframes, Support Gear for USAF TS-609A

Dallas—Chance Vought Aircraft was selected a \$1.7 million contract but not to build the vehicle and special support equipment for TS-609A, the Air Force version of National Aeronautics and Space Administration's solid propellant Scout launch vehicle.

Vought Aerospace Division will build airframe parts for the first three stages of TS-609A, including turbine motors which connect the rocket motors, stage separation devices, control surfaces and jet valves, igniters and airframe valves, and wiring packages. Company also will supply minor ground equipment. Vought is airframe contractor for all four stages of the NASA Scout.

An F-106 3-Stage Missile Division will launch TS-609A from Altitude Missile Range to study ballistic missile counter-problems and techniques, to test legs, seek, launch of such space vehicles as the Deimos probe and to launch various, other research and development payloads. The rocket will be able to load a 100 lb payload in an altitude of 7,000 m.

Aeronautics Division of Paul Mor for Co has an Air Force contract to design and develop payload carrier and integrate experiments into the payload carrier for TS-609A launchers. Aeronautics also has a stress engineering and integration responsibility for the USAF vehicles and is in charge of drawing specifications for any modifications ordered by the Air Force. Company will be responsible for installation, flight and launch of the TS-609A vehicles at AMR.

Air Force and Aeronautics plan to use a variety of combinations of the four solid propellant engines available.

in the basic literature Scout vehicle USAF apparently will cut two and three stage vehicles along with the four stage version. Engines in these configurations will be the first stage Scout engine, second stage Thorolite Center, third stage Hercules-Miguel. Ballistic Laboratory M-154 and fourth stage Hercules ABM X-754.

Standard payload carriers will be used in all the configurations, and a standard equipment package recovery system has also been developed. A standard intelligence unit to be carried in all flights will also require, need for modifications to the TS-609A vehicle. Unit will include guidance equipment, multi-channel telemetry and tracking beacon and full complement of vehicle test instrumentation. As with the NASA Scout, TS-609A will have a Minneapolis-Honeywell guidance system.

Air Force and Aeronautics are scheduled to launch a TS-609A from AMR before the end of the year. NASA has attempted one Scout launch using live engines only in the first and third stages. Third stage engine failed to ignite. Apparently NASA will not repeat the launch, but plans to go ahead with a full four stage test launch sometime this summer.

United Wins Contract For Segmented Engine

Stoughton, Calif.-based Rocketdyne Corp. is working under contract from National Aeronautics and Space Administration to demonstrate feasibility of segmented, segmented, solid propellant motor design. Contract calls for design, fabrication and testing of three experimental engines with the program to be carried out this year at United's new facilities near Irving, California, and at its Los Angeles, Calif. divisions. For the engines will be fabricated by Pratt & Whitney Aircraft Division of United Aircraft Corp., of which United Technology is a subsidiary.

United Technology previously had received an extended award of design, manufacturing and test propellant rocket engines of varying sizes, a program which makes use of rocket-bonding segments of special design.

Small test rocket motors of the new type already have been designed. Fabricated and tested with excellent results as part of an intensive research and development program, according to Robert A. Ashworth, United Technology executive vice president.

X-15 Control System

First airborne checkout of the North American Aviation X-15's ballistic control system was accomplished on the sixth powered flight of the rocket plane, which ended, powered flight as the first.

Rocket control system "spontaneous well" at 90,000 ft altitude at a speed of Mach 2 with pilot Scott Crossfield at the controls, although the system actually is not needed much below 100,000 ft. Designed for an altitudinal position of the X-15 system program, the hydrogen peroxide powered jets are installed in the nose and wing tip fin area, side control and steering from 40 to 130 ft of thrust. The 9-in. jets, each, including 4 mm under rocket power, also furnished stability and control in re-entry.

Rocket Engine Award Given to Rocketdyne

Washington — National Aeronautics and Space Administration chose Rocketdyne Division of North American Aviation last week to develop a 200,000 lb thrust liquid hydrogen oxidant engine to power the Saturn S11 and S1B stages.

Rocketdyne was chosen from a field of five original bidders in the competition, which closed Mar. 14 (ENR Feb. 15, p. 44). The company estimates that the three year engine development program will cost \$44 million.

Liquid hydrogen fueled Rocketdyne engines will be used in upper stages for later versions of the Saturn launch vehicle. Two engines will be clustered on the S-11 stage, and later four engines will be used in the S-1B stage. First version of the Saturn vehicle will have two 200,000 lb thrust Pratt & Whitney XLR119 hydrogen engines in S-V, the third stage, and four of these engines in the S-IV second stage.

Engines with the Rocketdyne engine will be added later to increase payload capability. Saturn vehicle with a second stage powered by two of these engines will have a lifting capability 50% greater than the initial Saturn vehicle. Adding a second stage, with four 200,000 lb thrust engines will increase payload capacity nearly 100%.

Although the engine is to have an overall potential of 280,000 lb thrust, Rocketdyne will be required only to meet a 167,000 lb rating at the end of the three year development period. The hydrogen peroxide will be a single chamber engine with an initial single stage capability. It is in the design stage, but is no later conversion to a multiple start motor.



First photos of Titan re-entry vehicle production show final assembly at Aero Corp. Aerospace Division plant at Storford, Conn. BVK 5 vehicle at the left (above), is a scale like the rest of order, is mounted on an Air Log ground handling dolly whose bright is calibrated exactly for loading on an delivery trailer at the left. This one is to prevent any surface scratch or dent. Tires are loaded onto USAF C-124s or C-119s and delivered to Cape Canaveral, Fla. No smaller dolly is used for subloading.

Titan Re-Entry Body Assembled



Titan re-entry body on BVK 6 vehicle moves with a supporting gas (above) in another flight, the assembly crane, mounted on a 160-ton turntable. Guide loading BVK 6 at left has previous for basic attachment in the yard and is used in loading the vehicle to the booster. Tolerances through 50 deg. at vehicle's center of gravity. First section of a semi advanced vehicle (bottom left), below is prepared for mating to the upper section. Titan section into which the vehicle is divided is the nose section. Rear end of BVK-6 vehicle shows delta nose, the white spot on the circumference of the base, and the control system containing the recovery equipment, including telemetry antenna, shafts, and a ballast. Container at right is handling equipment for installation of components in the cylinder section. BVK-6, a vehicle part of a fully developed Saturn IV loading in the development of the Saturn IV (opposite page one).



Defense Opposes Bill to Tighten Incentive Contracting Practices

By Katherine Johnson

Washington—Department of Defense strongly opposed legislation which would ban incentive payments on its contracts unless the contractor can "completely demonstrate" that he can control them. Opposition was expressed at hearings last week before the House Armed Services Committee.

The legislation, which also has provisions aimed at increasing the use of alternative bid contracting and at increasing competition in negotiated contracting, is sponsored by Rep. Carl Albert (D-Cal.) chairman of the committee (AW May 16, p. 115). It was drafted in the General Accounting Office.

The bill is a byproduct of hearings last year on evaluation of the acquisition law, during which the armed services and Department of Defense agreed an amendment that would have captured incentive earnings under incentive-type contracts—usually used by Air Force and Navy in missile and aircraft procurement—before the regular negotiation process. Veterans charged

at the time that the objective of the incentive was contrary profits and he recorded as having the negotiators his extended without significant change for three years, to June 30, 1962.

The Veterans legislative proposal an incentive payments is that "no contract negotiated shall contain a profit formula or price schedule unless provisions that would allow the contractor increased fees or profits for cost reductions or target cost underperformance from contract other than those which the contractor can clearly and completely demonstrate are due to his skill, efficiency, or ingenuity." It also has no sharing of cost reductions to those in to which such profit is possible, except other cost reductions would never be made because there would be no incentive for the contractor to make them. He suggested that there would be "a positive incentive" not to make cost reductions so the contractor could keep his profits high, and keep both costs and profits high in follow-on contracts.

Veterans committee also said that of GAO and the Reorganization Board is that the contractor "no longer" make incentive-type contracts for the most part but have been due to cost overruns when the target price was established. After less than 100 incentive contracts in its missile procurement, instead of the fixed-price incentive type, on the grounds that the real savings from contractor efficiency or ingenuity can only be determined and awarded

following actual production experience. Assistant Secretary of Defense, for Supply and Logistics Perkins McGee said the Armed Services Committee that the effect of the Veterans proposal hitting at incentive contracts would be "to force the Department to enter into more and more cost-plus-a-fee-for-research" which are "frequently the most costly and inefficient types of contracts."

In making cost reductions, McGee said, "we want all possible reductions and not put those which the contractor can clearly and completely demonstrate are due to his skill, efficiency, or ingenuity." If no hard-on sharing of cost reductions to those in to which such profit is possible, except other cost reductions would never be made because there would be no incentive for the contractor to make them. He suggested that there would be "a positive incentive" not to make cost reductions so the contractor could keep his profits high, and keep both costs and profits high in follow-on contracts.

Veterans said incentive-type contracts McGee reported, "he demonstrated" that it is made more important in dollars to the government to assure that all potential savings be made with as much as 85% of such savings reversion to the government, that it is to discourage the part of such savings which because they were not demonstrably "earned."

McGee noted the administrative difficulties involved in determining cost savings actually "earned" by a contractor. As an example, he pointed out that it would be difficult to determine whether a reduction in the price of subcontracted components was attributable to the efficiency of the subcontractor or to the contractor. They had been about through difficult purchasing in the prime contractor. McGee said it is to be "cured" when amount McGee observed would be increased and cost savings would be increased and increased subcontractor's costs.

McGee also opposed a provision of the Veterans legislation which would require that a decision to enter a cost-plus contract be made at the Defense and service secretary level on the grounds that it would expose a private banker to the uncertainty. At present, the authority is delegated to contracting personnel under regulations providing detailed guidance as to when these types of contract can be used. McGee pointed out that only the contracting officer is familiar with the specific details of a negotiation, and that he cannot further be applied by the secretary of such individual contract exposure to the both arms and not totally impartial administration.



French Rocket Telemeters Re-Entry Dots

French rocket telemeter which was fired last month from the Fu de Lavent was designed to yield data on ballistic missile reentry. First and third stages were made by SEPR rocket company. Second stage was built by French navy. First stage was made by Office National d'Etudes et de Recherches Aeronautiques, which provided firing and programming for that section, which has major responsibility in the French ICBM program. The first flight of the 40-ft rocket lasted 6 min 15 sec. First stage delivered 44,000 lb thrust for 5 sec before separating at 1,900 ft. Second stage delivered 4,400 lb thrust for 31 sec and separated at 73,000 ft. Third stage delivered 3,714 lb thrust for 46 sec and coasted while to about 90 mi altitude at 3,500 mph. Third stage separated during descent when fourth stage ignited and accelerated missile to maximum descent speed of 3,500 mph, at about 14 mi altitude. Nose cone instrumentation included telemetry transmitter with 16 telemetry channels.

News Digest

Kanran H-42B has been cleared for operation as soon as observation has been satisfied. Helicopter was grounded May 9 because rotor blades struck the vertical tail during certain approach-flight conditions. Up 10 m of the observation tail will be replaced with a light plastic material that will not damage rotor blades, strike it. After test of the 15-14-15 design, so it is expected to take two weeks.

Indian technical delegation is scheduled to visit Sikorski Aircraft this week during a U.S. tour which is part of a continuing study of helicopter production in the Republic of India. Indian government is studying both U.S. and British types Sikorski Aeroshell licensed Agusta M1550 Helix Industries, Ltd., to produce and sell the two-engine \$61 m Agusta and other Agusta countries Japanese are considering both military and civil use of the helicopter.

Air Force-Martin Titan entered an operational Area Mark IV was, cost to be \$10,500, on 10th day after Atlantic Marine Range. SAC effect on the readiness for the first time on that flight, which was reported to be the 12th successful flight in 35 launches.

Nose cone has been downward into the atmosphere, in a variety of test observations characteristic during a Black Knight flight from Woomera, Australia, May 24. Black Knight carried a solid propellant second stage which was fired 10 seconds after it had fallen within 70 m of the earth.

Latin Industries has won Navy competition to develop an automatic stellar control navigation system for use in an aircraft long range. Navy aircraft Kolben Instrument will provide star-tracking element of the system under contract to Latin. Program will be monitored by Naval Weapons Facility at Indianapolis (NAF).

SRA, French rocket company

month engaged in subcontract work, in designing a first test for a large cargo aircraft called the Fennec 273. Contractors will be two Frenchmen, who have built up of 100 ship each. Fennec would be 12 first-class passengers, 16 in economy class. Cessna is preferred.

Strategic Air Command will begin testing Minuteman infrared equipment and techniques June 20, using facilities at 11 D-8 airfield. Special teams will make six trips in a test week scheduled for completion by November.

Air Force has awarded a \$12 million contract for research and development work on graphics to National Graphics Co., a division of Union Carbide Corp. Company will build a laboratory at Luxembourg, Texas, for part of the work. USAF is interested in graphics in a structural material for tanks and space vehicles because of its strength at high temperatures.

Nationalist Chinese air force is getting Lockheed F-104B supersonic day before under the Military Assistance Program (AW May 25, p. 51). First two fighters were delivered late last month to Kuan Air Base, Taiwan.



Morine Corps GV-1 Tonker Makes First Hookup

Commander F.W. New Jr. is reflected by Lockheed GV-1 paratrooper train in the first landing of the new U.S. Marine Corps tonker version of the C-119 in a jet engine. Design can be extended from push under both wings of the plane to counter a maximum weight of 200,000 lb. New tonker goes into service this year and carries a total of 10,500 gal. of jet fuel, consumed at 140 gph. Photo was taken from USAF C-119B.

AIR TRANSPORT

Airlines Will Fight Transport Integration

ATA wins right to enter ICC case considered test of railroad drive for common ownership authority.

By L.L. Doty

Washington—Domestic scheduled airlines won the right last week to enter case in an Interstate Commerce Commission hearing which the airlines view as a primary test case in the current drive of major U.S. railroads to enter air transportation.

The ICC case, involving the proposed sale of the John I. Hays Co. large line to the Illinois Central and Southern Pacific railroads, again focuses attention on the growing conflict between the rail and air industries over integration of all modes of transportation either through direct acquisition or new entry. Air Transport Association was accepted as a party to the case in behalf of the airlines.

So far this case, which has been scheduled in the House and filed in the Senate, each of which is written to facilitate common ownership of two or more forms of transportation. The airlines' opposition opposed new entry and have taken care in the ICC case to go as far as possible to make the final decision will act a precedent in the House at stake.

Thus the battle lines between the air industries are clear with the railroads going against support in their drive to remove restrictions that prevent them from operating air services as headpiece to their existing highway or waterborne operations. Airlines are fighting for complete independence, charging that the railroads seek a free and unbridled entry into air transportation that will destroy competition.

The railroads have brought and second phase, scheduled in recent months that indicate the governmental agencies are ready either to open or close the door depends on the prospect of common ownership. For example, the Commerce Department in its recent report on a federal transportation policy, made the new entry of airlines into air transportation.

Generally, control of one mode of transport by another is not considered to be an economic advantage, although a more flexible attitude on the part of the regulatory authorities is desirable where a clear demonstration can be made that common ownership will be beneficial.

Alan S. Boyd, newly appointed secretary of the Civil Aeronautics Board, is clearly made this statement, leading to a study of the proposed case, which is not a closed case in the CAB is concerned.

It is not judgment that the use of combined or joint assets with other facilities can help achieve the potential in air freight. Without ignoring nature in the distance, the new case will arise when common ownership of

either the limited entry into air transportation possible under the existing regulations or the Airlines Act, etc.

The proposal is in direct conflict with long-established and frequently reaffirmed congressional policy in providing the independence of the various forms of transportation.

Stipules argued that integration would lead to transport monopoly. The fact that the general public interest would not be promoted by permitting all modes of transportation to grow into a few general private transport companies with fewer assets of control.

The railroads have labeled the charge of monopoly as "bald." They point out that even with the removal of existing restrictions all applicants—including the railroads—could be required to justify their entry into other areas in the public interest.

All bids for acquisition of existing carriers or for new entry will require consideration of the competitive effect by the regulatory agency under an order that is issued.

In testimony before the Interstate Commerce Commission last week, ATA President Stuart G. Tipton gave a parallel between the long lines and railroads and the relationship to the railroads. He said:

Both air and large line have small investments relative to those of the railroads. Both are subject to the same public will be determined by the entry of the controlled mode. Both compete with the railroads. Both have expanded a spectacular growth in the world since World War II, and we suggest that such growth will not be brought to an end through railroad control.

Tipton pointed to the heavy capital outlay made in the airline industry in the past few years and said he doubted that if the airlines had been under the control of "conflicting" transport interests, the public would have available to it the air transport service now under.

Although other forms of transportation are opposed to railroad proposals for common ownership, they are in general agreement that joint rates and fares will be developed if a properly coordinated transportation system is to be maintained. The Federal Aviation Act of 1958 allows for the development of such rates and provides for creation of a joint rate commission of members of the ICC and the CAB will still production over through-routes and rates.



New Passenger Wing, Tower for Vnukovo Airport

Construction has begun on the new, two-story passenger wing at Moscow's Vnukovo Airport. Shown to the right of the present terminal, which is in the center of sketch, the new structure will accommodate "up to 2,000 passengers" at one time. It will be connected to the existing terminal by bridge. Completion is scheduled for 1961. Proposed new control tower and administrative offices are shown at left.

Aeroflot Modernizing Medium-Haul Fleet

Moscow—Aeroflot is embarking on a new equipment program to replace its medium-haul planes powered by 134 five-cylinder turbojet and turboprop engines, according to Gen. Gennadiy Logvinov, head of the Soviet airline.

The new medium-haul transports are •Tu-124 powered by four Soloviev engines described by Soviet sources as of "domestic origin" design. Emphasis on the outstanding fuel economy of the new Soloviev jet engines reduces the disengagement was a moderate public reaction to describe turbojet engines.

The Tu-124, prototype of which was rolled out last December, was originally thought to be a supersonic design. Gen. Logvinov said it resembled the Tu-104 in general configuration but had a 40 percent increase in maximum speed of 500 mph (700 km). Maximum cruising range was listed as 5,000 mi., cruising at 3,000 ft. altitude.

Gen. Logvinov said the Tu-124 could save money, from which the 114 is expected to be replaced. The new aircraft is a 2,500 ft. (760 m) replacement for the new transport.

•An-24 powered by turboprops. No further details were available on this new aircraft other than that it is a product of the design bureau of Gikg Arzhanov and probably uses a new design Kuznetsov engine of lighter weight and better fuel economy than the type used on Kuznetsov and Ilyushin turboprops used on the An-10 transport. Gen. Logvinov said the An-24 would also be used in an An-14 replacement program in the areas where gun air fields and production.

Soviet designers have been working

on supersonic transport designs, according to Gen. Logvinov, who said he plans to introduce this type to Aeroflot in a few years.

"I don't know who will be first to have a supersonic transport," he said, "but we won't be the last."

In addition to its acquisitions for air and service between Moscow and New York, Aeroflot is also planning to extend its foreign routes to Japan and Indonesia, according to Gen. Logvinov. He and Aeroflot had conducted talks at the technical level in both Japan and the United States but that no general level approach had yet been made in Japan similar to the offered U.S. negotiations scheduled to begin in New York, Feb. 18.

Aeroflot landed 70 million passengers during 1959, a total equal to its combined passenger traffic from 1952 to 1955, Gen. Logvinov said in providing the first absolute traffic figures for the Soviet airline since its reorganization.

Gen. Logvinov said the first selection of the impact of large scale jet service by Tu-104A and the An-24, the 115 turboprop and the An-12. Gen. Logvinov said no specific reference to the Tu-114 which is still being a study, proving flight between Moscow and Kharkov, on the Trans-Siberian route.

The Aeroflot route pattern as it is now developing, utilizes the Tu-104B and the 114 on its main trans-Siberian routes, with the Tu-124 and An-24 scheduled to operate medium-haul routes between large cities. The 114 pattern expects that has been operating the medium-haul routes will be pushed back

to a feeder-line service connecting about 1,000 smaller towns with the big city traffic hubs. Role of the An-10 is still not clear.

Aeroflot is aiming at reaching a 70 million passenger level by 1964, according to Gen. Logvinov, who predicted that when the current Soviet size plus adds in that way, 50-60,000 passengers would be moving through Moscow on trans-Siberian routes.

An huge release in being received from 30 to 40% this year over 1959 with emphasis on flying freight and passengers from the southern region to the large industrial cities of the north. Helicopter service passenger volume increased 10% in the first four months of this year compared to the same period in 1959, and new types of helicopters are being developed for handling electric power transmission lines and oil and gas pipelines.

All international air service by Aeroflot and the foreign flag carriers on its highways shifted on June 1 from Moscow to Sheremetyevo airport because the facilities at the older airport were overused by the increasing traffic volume, particularly those for handling foreign passengers. Gen. Logvinov noted that new terminal facilities had been under construction at Vnukovo for two years and said "we simply couldn't wait any longer." Sheremetyevo has a new passenger terminal, but it has only a single runway about 7,000 ft. long with high intensity approach lights at both ends and GCA landing aids. A system type instrument landing system is scheduled for installation there next fall.

American Sues TWU

Twelve American Airlines filed a \$100,000 damage suit last week against Transport Workers Union for an alleged "outrageous violation" of Local 514 No. 10-A. The suit was filed in U.S. District Court.

On Apr. 12, American was granted a permanent injunction against the union, which, the airline said, caused a five-day work stoppage at its Tulsa base and elsewhere as it voted

Flight Recorder Competition Grows As ATA Asks Deadline Extension

Washington—Competition to provide the airlines with an all purpose flight recorder is gaining momentum in the wake of a Federal Aviation Agency proposal to require the mandatory installation of accident on all turbo-powered aircraft by Sept. 1 (AVW May 16, p. 38).

Although it doesn't record all the data taken by the all-purpose recorder, the Lockheed Aircraft Corp. Model 109-C (see sidebar column, right) is one of the most serious in a leading contender in the competition. It doesn't provide maintenance data, but the company says that it is likely to be required the second data required by the FAA proposal, and it could be deleted on short notice, in sufficient quantities to meet airline needs.

At the same time, the Air Transport Assn. has asked FAA to extend the installation deadline until May 15, 1961, to give manufacturers an opportunity to evaluate the more sophisticated, multi-channel magnetic tape recorder, which can provide both accident and maintenance data.

The same data would also cover the purpose of many current units intended to use the LAS 109-C recorder. ATA and one of the largest prospective users—Capital Airlines, with a fleet of 50 turboprop Viscounts—plans to install the LAS 109-C on all its aircraft by May 15, 1961, ATA said.

ATA's request has opened the idea of a program of other manufacturers offering similar complex systems to grant competitors such as the Minneapolis-Thamesville Regulator Co. and the West King Corp.

Lockheed Aircraft Corp. also has entered the field, with an individualized recorder, rather a sub-system with Raytheon Instruments of England, to market the British-built "Mala" magnetic tape recorder in this country. Lockheed said the new competitor will be sold under the name of Lockheed Maintenance Recording System. First units would be ready for delivery by November, with shipments expected to reach 70 a month by January.

Minneapolis-Thamesville recently completed a flight demonstration of its VG-8 magnetic tape recorder in a DC-3 for the FAA. On a span of 7 1/2 hrs., the VG-8 records altitude, speed, heading and engine indications into each channel to meet FAA's requirements for accident analysis.

The unit also contains one digital channel which can be used to record up

to 60 other data aspects at a sampling rate of one per minute, plus a separate audio channel for in-flight pilot observations to be recorded along with performance data. Speeds of magnetic tape last 150 hr., and written along heavily magnetized tape can withstand a temperature of 2,000° for 15 min. and exposure to salt water for 30 hr. Playback can be accomplished through the use of an in-cabin instrument type display, a Vocoder, digital recorder and printer or large scale digital computer. Honeywell estimates the new flight recorder will sell for less than \$10,000 and will be available in December, with delivery at 20 a month by January.

West King Corp. flight recorder uses a magnetic-coated tape which is divided by means of travel sprockets on both sides of the tape at the rate of seven per second. All of the required LAS information can be recorded on one side and as many as 20 extra data channels are available on the other side, the company said. The unit's tape is 1/4 in. wide, 100 ft. of tape which will last 200 hr. and will withstand a 2,000° fire. 10-lb shock and immersion in salt water for 30 hr.

Four levels of isolation are available with the West King, including pointed collations on the tape, proportion of the record onto a screen, synchronous methods to digitize information directly, and a fully automatic data reduction system which would allow the reduced data to be fed directly into computers. West King said it has designed such a solution system and will undertake the engineering of this in a demand.

West King said its recorder, now being produced and shipped at the rate of 70 a month and this is expected to reach 100 a month in the near future. Cost of the unit was quoted at \$6,950, with 125 man hours needed for installation. The company has sold an estimated 100 units to date.

Delta 880 Damaged In Landing Incident

New York—Delta Air Lines' Douglas 880 which returned to New York International Airport last week after failure of its No. 3 hydraulic system landed on a Dutch rail trolley on its final approach to the runway. The jet transport was still wired when it made contact with the trolley and struck it. No injuries paid during the landing.

No injuries to the 72 passengers and no new injuries were reported. The flight was scheduled enroute to Atlanta

The plane approached the runway at 178 ft. with 10 deg flap. The nose gear was lowered by hand because hydraulic power was inadequate. The pilot had only eleven ft. of rail control because the trolley could not be activated. Advancers should provide 15% of lateral control, speed the other 85%.

The Dutch rail began at about 10 ft. above about 1/2 mi. from runway. The 880 is powered with a No. 2 hydraulic system designed to do the full job as long as there is high boost on the pumps. Hydraulic power from the system could result from the pumps not getting out enough power, or from a being inoperable, or failure of the system. Captain of the 880 did not declare an emergency. Damage to the aircraft was slight.

Board Denies Permit For BOAC Charter

Washington—Civil Aeronautics Board denied last week the application of British Overseas Airways Corp. to operate eight round-trip transatlantic charter flights for the Joint Committee of the Councils of the Bus and Low Society of Great Britain.

Board based its action on the finding that the charter would not be bona fide since passengers on the flights would be able to select which of the eight flights they wished to travel on instead of being in a group going and returning. This is termed interlining and is prohibited by the Board's Economic Regulations.

Charters were planned to transport members of the Joint Committee to Washington for the annual meeting of the American Bar Assn., Aug. 27 to Sept. 2, and the Commonwealth and Foreign Law Conference in Ottawa, Ont., Sept. 14-21. Seven of the scheduled flights would have terminated in Washington, the eighth in New York. Furthermore, one of the flights would have originated at Buffalo, N. Y., and the remaining two in New York.

The Board also pointed out the continued membership of the Joint Committee in 1960, which is higher than the 15,000 members of the International Air Transport Assn., of which BOAC is a member.

CAB sets a maximum of 5,000 members for an organization, and the Board said any larger group would be ineligible to participate in charter trips.

CAB said BOAC is not eligible to accept the responsibility should the flights be carried out. In fact, the carrier's own rules prohibiting charter travel from a membership of this scope, and in fact of the Board's having established its standards and prohibition against interlining.

Cable of Boeing Air Lines' Flying Fortress shows outer main, inner main, and forward wings on main gear. Loading of up to 34,000 lb is possible on each of the five mounted Super-C Gensetboxes is provided by truck lift tracks.

Eastern Converts Super-Cs to Cargo Freighters

Cargo loading equipment at after end of cargo area includes hydraulic loading door, in-cabin telephones, roller tracks and portable electric machines and system for loading and unloading palletized cargo. All right cargo is enclosed in moisture proof and fire-resistant system with special nets and straps.

Eastern's Flying Fortress will provide overnight overnight service at 529 mph, leaving any other on Eastern's system.

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AVIATION WEEK, June 4, 1960

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Capital Employee Group Begins Proxy Fight

Washington—A group of Capital Airlines employees last week made good a threat to conduct a stockholder proxy solicitation in a first step toward overthrowing the airline's present board of directors and at least part of its operating management.

The activist group, called the Capital Shareholders' Association and numbering over 1,100 members holding some 20,000 shares of common stock (AW May 9, p. 50), made plans to issue 5,000 stockholders' calling for a special stockholders' meeting for the purpose of replacing the board of directors with a slate of its own. Under the bylaws of the corporation, such a meeting can be called by a vote of 25% of the outstanding shares of common stock.

Mizzaloh, Capital's management last week expressed some confidence that it would escape from the fiscal plight brought on by a series of heavy losses and a net filed by Victim-Airways asking for appointment of a receiver to sell Capital's fleet of Victorias to pay \$51 million due on capital notes (AW Apr. 15, p. 38). Airline officials said the company is negotiating with U. S. representatives of Victim in an attempt to settle financial problems out of court.

But any of the latter course which Capital officials feel will help ease the pressure which has mounted against the company during the past two months.

• Thomas D. Neuland, Jr., a New York investment banker, replaced George Blum as board chairman when the latter declined to stand for reelection (AW May 22, p. 30). Neuland wants the job of developing a refinancing plan that will not only be acceptable to the British stockholders but will enable the airline to reduce its reorganization program calling for the purchase of a fleet of Conquest 380 turboprop and Lockheed Electra turboprop transports.

• Victim-Airways asked for a 16% postponement of its court-ordered sale against Capital on May 23. This is the second postponement the court has ordered since the suit was filed Apr. 10 (AW Apr. 15, p. 40). The first postponement was granted by the court in the vigorous protests of Victim.

• Capital withdrew its request to the Civil Aeronautics Board for subsidies on grounds that a face increase would inhibit the need for such aid. Capital had filed a tariff calling for a rate increase of 4% plus \$1 on each ticket. The carrier estimates that will give it an additional \$2 million in revenues during 1960. Capital also asked that a full-rate CAB probe be called off in recognition with the withdrawal of the subsidy request (AW Apr. 15, p. 38).

CAB complied with the Capital request and dropped the investigation, but it is now about to determine whether the airline's routes and operating certificates should be denominated in whether the carrier should be assigned part or whole or other routes.

Charles E. Butler, a senior partner with Capital and president of the Capital Shareholders' Association, found nothing in these actions that would persuade him to either stop or defer his plans to overthrow Capital's management. On the subject of the proxy fight, he said:

"I assume that Capital withdrew its subsidy application because of its apparent fear of the CAB's promised investigation and a conclusion that the subsidy was not likely to be granted soon."

The group was even less sympathetic with the appointment of Neuland and described the "widely publicized 'shake-up'" in Capital's management as "a mere window-dressing." Charging that

the airline's management is "infringing on a voteless," the proxy fight will be a challenge to the decision structure (AW May 30, p. 41).

"Except for a new chairman, the board means the same group whose members have led Capital in the range of bankruptcies. All we see in the current management reorganization is a consolidation of some jobs and no sign that the drastic action as badly needed is going to be taken in the near future."

That fact, Capital's top management has made no effort to prepare for an internal battle against the attempts by the employee group to overthrow the board of directors, although it has started an incentive program designed to curb the sale of all employees in accelerating sales and improving operating performance in one means of getting the company back on its feet. The program, which began last week, provides for a bonus to employees who make the largest contributions in these areas.

Meanwhile, the Capital Shareholders' Association has not attracted new recruits as its great members since the first steps of applications following the Victim-Airways suit brought membership up to 1,100, about 50% of the total vote force of the airline.

Privately, a number of Capital officials revealed that the group might be successful in capturing control of the company, although there were some who doubted that the average stockholder would be willing to relinquish his vote to a group significantly unrepresented in various business services.

"The association will use all its members in the solicitation of proxies and will report that all such work is conducted during the employees' off-duty hours," Butler, however, noted a number of pilots, mechanics, and personnel, mechanics and clerks will not be compensated for their work.

In addition, the association will ask holders to keep their names and others who hold stock in their names to report proxies from persons owning such stock. It is estimated that \$15 of some 200,000 shares outstanding is held in the street name of William A. Blum of New York, has been requested at a fee of \$1,500 to act as the solicitation of proxies of stock held by bank trust houses.

According to the proxy statement issued by the association, cost of solicitation will amount to approximately \$15,000, of which approximately \$4,000 has already been spent. Reimbursement for such expenditures will be sought from Capital Airlines, the proxy statement said.

Bond Group Formed

New York—A committee to protect the interests of holders of about \$12 million in Capital Airlines debentures has recently met with other parties associated with Capital's financial troubles in an effort to negotiate a solution. The Capital Action, Inc., Debenture Holders' Protective Committee does not plan any action against the airline at the time since Capital has been meeting its semi-annual debenture payments. Next payment is due July 1.

The committee, under the chairmanship of Gordon F. Birkall, managing partner of Corbin and Co., has met with Capital management with Business Trust Co., the debenture holders' bank, Victim-Airways, Capital's first aid committee, and with counsel for the trustee and Victim. The committee is meeting on the issue to work out a solution and may provide more new financing.

The debenture holders' protective committee was formed shortly after Victim announced its bankruptcy plans. Birkall, formerly abroad, the debenture holders by letter of the committee's organization to protect the holders' investment as one of "recent disturbing developments" concerning the airline.

"The committee does not intend at this time to solicit support from other debenture holders but does intend to do so from time to time to take such action as may be necessary for the protection of the debenture holders." Birkall wrote.



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Congress Weighs New Authority for CAB

By Robert H. Cook

Washington — Congress weighed changes in the Federal Aviation Act last week which would permit supplemental airlines a type of scheduled service currently challenged by the U. S. Court of Appeals.

Civil Aeronautics Board has suggested changes in the act which would clearly give the Board power to issue the kind of operating certificates under which supplemental airlines may fly. This CAB authority was questioned recently by the Court of Appeals (AW Apr. 18, p. 46), and the Board reacted under a time 7 court deadline to get the authority it needs from Congress.

If congressional action is not fast enough to meet court deadlines, or if Congress refuses CAB the authority it wants, the effect of the Court of Appeals decision on the supplemental element may be delayed by an appeal to the Supreme Court.

Senate and House aviation subcommittees are considering legislation that would amend the Federal Aviation Act to permit CAB to regulate the supplemental carriers for limited scheduled operations. Proponents of the legislation come in the wake of a decision from the U. S. Circuit of Appeals which last month ruled that the Board exceeded its authority in granting three to five year temporary operating certificates to 25 supplemental airlines in January, 1979.

Court said the CAB failed to comply with the Federal Aviation Act in granting blanket authority for the airlines to operate between any two points in the U. S. on weekends not to exceed 30 days a month in the same direction. The award of unlimited charter authority to the airlines was also questioned by the court, which ruled an appeal filed by United, Eastern, Pan American, Texas Western, American, Delta, Northwest and Northwest Airlines and the Airlines Association of Santa Fe, New Mexico.

Effect of the bill would amend CAB's authority to issue, and strengthen CAB's position to deny, certificates for supplemental scheduled service and they would the present status of supplemental carriers.

CAB officials supported the changes in January, but its subcommittee found inadequate testimony from the Board. Clarence W. Wynn, CAB's legal counsel, said the statute quo of the supplemental line plus other issues that would strengthen them, but Vice Chairman Chas. Canine, said that the current law applied at such that their present power and restricted to charter flights.

CAB said immediate legislation is needed to "meet the grave problems" of the supplemental industry, and he expressed doubt that once the Court of Appeals order becomes effective, CAB can permit the supplemental to operate by means of emergency because of past court decisions on similar issues. He noted passage of legislation which would clearly make legal the Board's action in granting supplemental operating certificates in their present form, in addition to awarding them permanent operating rights.

Continuing court criticism that the Board had granted certificates to airlines financially unable to carry out any large scale operations, CAB also recommended that any new legislation contain a provision that a determination of financial status of such a carrier be related solely to its ability to conduct a supplemental operation. "Rather than an obligation to perform a non-transport service."

Canine criticized the supplemental operations and told the subcommittee the service provided by scheduled trunk and local service airlines is adequate. Based on more than nine years of service as a CAB member, Canine said, there is "little need" for supplemental operations. He recommended that the carriers be confined to unscheduled charter services. Of a total of 25 supplemental airlines which received their operating certificates last year, he said, 10 failed to conduct one individually scheduled flight prior to June, 1979, and four of those failed to operate a year-round flight at any time.

"It is no firm belief that the intent of the supplemental industry, like the intent of the charter industry, is to provide a service to the public, but to provide a service to the airlines," Canine said.

Canine also took issue with a proposed amendment to the Federal Aviation Act which would permit CAB to expand the supplemental's authority to include express and emergency transportation. Noting the heavy competition of 31 flag carriers from 14 countries in the over international routes, he told Congress that adding the supplemental carriers to this market might "pose a further threat" to the financial position of the carriers on the routes.

Robert G. Tipton, president of the Air Transport Association, generally supported Canine's stand and opposed the CAB-issued legislation. ATA would also limit the supplemental's authority to scheduled service but object to any increase in the number of airlines which could fly. He said that if the law could be changed to allow the introduction of Vanguards as scheduled airlines.

ports to be served. Tipton said CAB had ignored the basic concepts of carrier license and public service needs in authorizing the supplemental services and urged a reassessment of the situation.

Clifton L. Burrell, president of the Independent Airlines Assn., told congressional members that following ATA's recommendations would have the "unintended effect of eliminating supplemental airlines from the industry. Maintaining that CAB action is the Large Transport Car last year dominated all by legal means. Burrell charged ATA with considering delaying tactics during the hearings in the hope that Congress may not act in time to help the supplemental industry. He added that without congressional aid, "there will be no further problems from the supplemental industry, to prevent a complete dismantling of the on transport industry by a small, determined group of large carriers."

Vanguards Grounded Due to Tyne Problem

Vickers Vanguard aircraft has been grounded because of a compressor wheel failure of the Tyne turbo-prop engine plant during a test run by Rolls-Royce. Grounding, effective May 23, also halts flight tests of the Canadian CL-44 at Montreal.

The Vanguard was due to enter service on the London-Pan route of British European Airways next July. The twin-engine aircraft, which carries up to 129 passengers, also can be scheduled for use with four engines. Canada Airlines, last September, Verrily the introduction of both these services would be delayed.

Canine was the chairman of one of the 15 emergency tasks, even as an appeal on a static acceptance test. Examination of other engines awaiting delivery revealed cracking in one of the shafts.

Rolls-Royce noted the first serious trouble spot of the high-torque engine, turbo-prop, designed to gross to 10,000 hp (AW Nov. 9, p. 98). Type Mk 12 produces 5,545 hp on a takeoff at 13,250 rpm.

Rolls-Royce does not at this point suspect any inherent design defect. Minor wear of the positioning could be a slight delay in deliveries of the engine. Most likely cause of the compressor wheel failure on a test defect is a rope failure of a rope which could, if true, could result in only slight delay in the introduction of Vanguards as scheduled airlines.

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AIRLINE OBSERVER

► State Department now feels that Soviet Union will accept a recent U. S. invitation (AW May 2, p. 25) to begin talks July 18 on a bilateral air transit agreement. Although no official word of acceptance had been received last week, State officials are anticipating a statement made last month at a press conference in Gen. Yegor Gerasimov, chief of Aeroflot, the Russian airline, as a highly indirect but affirmative response to the U. S. invitation. Gen. Gerasimov said the two governments will meet in New York on the date requested by the U. S. When negotiations begin, U. S. negotiations will be headed by Edward Rother, who replaces Laurence C. Vance Jr., IV as director of the Office of European and Commonwealth Affairs.

► Aeroflot is testing a long-haul, 75-seat version of its turbo-prop B-116 transport. New configuration has a third passenger compartment in the tail with eight sleeper seats. To make room for the extra compartment, a dual cockpit and one lavatory were moved forward to the area which absorbs the main jet-propeller shock. Front passenger compartment is the new version has 28 seats, and the main compartment 50 seats. Another version of the B-116—designed to carry 125 passengers in short-haul operation—is under development.

► Failure of host rotor bearing on Bullock-Rovine Comair engine has caused an eight engine shutdown on some flights of Boeing 707-420 transports. Air India has had two shutdowns, KLM one and Boeing Airplane Co. one to date. Bullock-Rovine is conducting a crash program to find a fix for the bearing. It also fears a host of other trouble could arise causing sub-standard damage.

► Iberia Air Lines of Spain now has to fly the Haviland Comet 4 to 60 out of its transport equipment requirements, even though Spain's Real Canalelle transport is the carrier's first choice. Iberia officials say the Canalelle is best suited for the airline's European routes, but the company lacks the funds to make required payments on the fleet of four Canalelles it wants. De Havilland reportedly is ready to offer Iberia the credit it needs to make a purchase, while Real Canalelle has not yet indicated it will provide credit or long-term payments on a Canalelle order.

► Delta Air Lines has filed a formal complaint with the Civil Aeronautics Board against Eastern Airlines of London, including and "disruptive" to airway services with its DC-8 service. Delta has charged that Eastern is advertising its DC-8 service by designating the airplane as a DC-8-50 although "there is no such aircraft." Delta said Federal Aviation Agency has officially designated the DC-8 powered by Pratt & Whitney T75 engines, flown by Delta as the DC-8-11 and the same transport powered with Pratt & Whitney JT-7 engines, flown by Eastern as the DC-8-31.

► Export-Import Bank of Washington will offer guarantees to exporters against loss due to political risks in connection with transactions already available on the usual credit side. Political risks include inability of buyer to obtain U. S. dollars at his bank abroad, cancellation of an export license, war, loss or requisition which prevent delivery of goods and expropriation of exported items by foreign authorities.

► Aeroflot has opened a destination ticket office in Cairo near the Nile Hilton Hotel. It is the first such ticket office to be operated by the Russian carrier in the Middle East. Aeroflot has a regular weekly service between Cairo and Moscow using B-116 transport.

► Investment climate for airlines has undergone a quiet change for the better during the last few weeks. Several major firms feel airline stocks probably hit bottom in April and now are ready to turn around. Optimism, however, is still cautious. One brokerage house said in its quarterly review that the lure of airline listings had been proved but made no forecast. No one expects rapid recovery. One serious market analyst pointed out that historically, after a long decline in a group, there is a period of accumulation with prices moving upward. Better earnings and evidence of a more favorable regulatory attitude will be necessary to give any major advance, and these prospects are not viewed as likely to materialize until next year.

SHORTLINES

► Air France reports its fleet of Sud Aviation Canalelle transport transports has carried 221,648 passengers and flown 141,269,625 enroute passenger miles during the first 10 months of operation, ending Mar. 31. The French airline also reported the Canalelle maintained a 56% load factor during all-season winter months and achieved a 91% on-time record for the 10 month period.

► Middle East has received a 90 day extension of its transport foreign air carrier permit authorizing the airline to operate to the U. S. pending conclusion of bilateral talks between the U. S. and Sudan governments. The permit was to expire May 29. Atlanta seeks additional permits to Montreal and Europe.

► Romania Air Lines has added two Tu-154D 127 turbo-prop aircraft to its fleet and now flies nearly 90% of the company's schedule.

► Civil Aeronautics Board has ruled the permit of General Air Freight Corp., an air freight forwarder, effective June 17. Board said General has not engaged in international for the past two years and was found a status of intent to cancel its operating authorization on Apr. 25, 1969. Board and the company did not operate as an air freight forwarder during 1959.

► Las Vegas International Airport handled 1,417,644 passengers during the first quarter of 1969, a 19.1% increase over the same period last year. The number of an carrier movements decreased by 7.36%, and the airport reported that daily aircraft movements were another 5%.

► Pan American World Airways reports that during the first five months of 1968, travel on the carrier's routes has increased 21% over the corresponding period last year. Largest percentage gain was on the polar route between the West Coast and Europe; where traffic rose 150%. Other gains on the carrier's routes were: West Coast-Honolulu at 72%, trans-Pacific at 66%, Pacific trans-Pacific at 55%, trans-Pacific at 16% and Latin American routes, 6%.

► Texas World Airlines and Eastern Express Airlines have agreed an agreement calling for shipment of cargo to and from non-carrier ports in surface route. Shipments may be categorized as air freight and delivered in surface equipment, at 100% rates.



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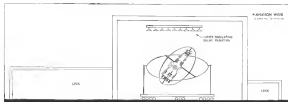
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SPACE TECHNOLOGY



SCHEMATIC section of planned space environment facility's general features includes full-scale space vehicle mounted on support system which would afford freedom of motion. Width of main chamber which would measure about 200 ft. is diameter; by 150 ft. high, would accommodate required for low temperature characteristics. Section of look would include preparation of test space vehicles, operation of ion and nuclear engines and implementation of safety provisions.

AEDC Plans Space Environment Chamber

Tullahoma, Tenn.—Response of full scale space vehicles, engines and engines will be evaluated under realistic physical conditions in a high environmental chamber planned by the Air Force for its Air Research and Development Command's Arnold Engineering Development Center here. The product will be the largest and most completely instrumented chamber of its type in the world.

The facility will duplicate available data in hardware for manned space missions will supply an overall study capability to minimize hazards and provide space vehicle problems associated with out-of-atmosphere travel.

Rigid Requirements

No detailed specifications for the facility have been formulated yet but the overall characteristics of the environmental chamber and its associated support and monitoring equipment have been established growth to embody the rigid requirements needed for realistic chamber.

With immediate implementation it is estimated that the full-scale space environment facility could be ready by late this year. To fit the gap between the full-scale chamber, being built at AEDC and probably will be available for operation within a year. A research program also is being planned concurrently to make sure of the problems involved in design and operation of the full-scale environmental chamber.

Living subjects—animals and humans

—will be included in the space environment chamber experiments being fed into the program with progressive changes of parameters governed by safety considerations.

Tests of ion engines operating under space conditions will be handled, the facility and the facility will be designed specifically to accommodate this type of research but engine exhausts will not permit checking of conventional rocket engines without destroying the realistic vacuum capabilities of the chamber. Except for an engine exhaust (temperature) and the overall difficulties associated with very high vacuum, existing techniques should be able to handle the requirements of the space environment chamber.

Operation of nuclear engines also will be handled. The chamber will be built with safety shut-down in the area where it joins the space environment chamber.

Space Chamber Values	
Chamber Size	8 mg
Pressure	10 ⁻¹¹ to 10 ⁻¹² mm
Temperature	4K to 2,000K
Ion Radiation	1,400 w-tray/m ²
Thermal Radiation	50 w
Acceleration	10 ⁻¹¹ to 10 ⁻¹² g
Shock	10 N to 200 N
Atmosphere	10 ⁻¹¹ to 10 ⁻¹² g
Molecular Particles	10 ⁻¹¹ to 10 ⁻¹² g
Ion Particles	10 ⁻¹¹ to 10 ⁻¹² g

its blocking off the methods portion of the look, it is clear it will be possible to accommodate the reactor in the look during engine operation. The space environment chamber also will have shielding to prevent radiation to the subject.

Methods will contribute another area of investigation in the chamber for determining their behavior under critical, critical atmospheric conditions. Computerized support and data-gathering capabilities will function to assist in research and return of information for precise control of chamber operation. Instruments for operational parameters, instruments for specific diagnosis, and the various measurements of the facility will be required.

Facility Features

Parameters for the environmental facility include these features:

- Configuration of the space environment facility is projected as a cylindrical structure approximately 200 ft. in diameter and about 150 ft. high.
- Pressure in the chamber is controlled at 10⁻¹¹ to 10⁻¹² mm (10⁻¹¹ to 10⁻¹² mm Hg) or 10⁻¹¹ to 10⁻¹² mm Hg (10⁻¹¹ to 10⁻¹² mm Hg).
- Heat sink with low-temperature and non-temperature characteristics, all heat the chamber completely and will be utilized to a steady temperature of 10K.
- Simulated solar radiation: applying

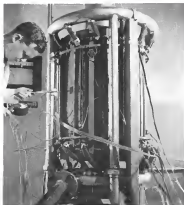


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1,400 watts per square meter will be obtained by a cobalt based of semiconductor and germanium-antimony alloys over the wide test range.

• Reflected water radiation (beta) will be simulated by a battery of fluorescent lamps. Induced radiation will be simulated by a bank of heaters.
• Wide variety of full-scale space vehicles will be able to be accommodated on a mobile support system rack which will allow the vehicle freedom of motion. A large mobile crane will facilitate handling the vehicle in the chamber.
• Systems of locks will implement the space environment chamber. A main lock, approximately 150 ft long and 50 ft in diameter will serve the test vehicle while it is being received on its support system, and during entry inspection (check-out) and collection.
• This lock will be depressed by pumps before the support system carrying the

vehicle is rolled into the space environment chamber.

A second lock, about 30 ft long and 30 ft in diameter, on the other side of the chamber, fitted with diffusion pumps, low-temperature plates and baffles to catch carbon products carrying toxic electrodes, will be used to take in the discharge from an ion engine under test.

Another lock will accommodate facility personnel desired in space suits to enter the chamber for maintenance, adjustment, and checkout of vehicles or components under test. Breach and fast shut locks will be entered and closed for use emergency within the chamber, which might entangle working personnel.

In addition to powered reaction locks, transportation also will be used to provide mobility for the life-support system. To ensure highest safety, it is likely that a "buddy" system will be

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NASA Ionospheric Measurement Satellite

Ionospheric Measurement Satellite S-92, which National Aeronautics and Space Administration will launch this fall with a Bios II sensor, will measure electron density, gradient and ion density. Payload also will include a microwave interferometer. Also scheduled for the fall is F-14 interceptive probe to measure magnetic fields.

also within the separate guidance system test chamber to produce desired levels to simulate that generated by various phases of space vehicle operation.

- X-ray and radioactive isotope generators will be installed in the space environment chamber for long-term low-level measuring radiation over the test vehicle.
- Magnetic coils will surround the test vehicle to provide fields similar to those which might be encountered by the vehicle in its space mission.

The space environment chamber and its auxiliary subsystem installations will require an extensive system of monitoring and control. The various control centers are projected to include those having facilities:

- **View control center.** This station will have surveillance of the complete facility, including the space vehicle under test, aerial or human test subjects, and maintenance personnel in side the chamber. In effect a command post, the center will include a complete complement of instrumentation, digital systems, plotting, communication system, and television monitors. It will also coordinate and monitor the use of auxiliary support systems and hold safety personnel for personnel.
- **Radiation control center.** This station will control characteristics of plasma, electron and ion beams, radiation of the plasma itself. It will also control the X-ray system and isotope and proton gas packages. Also controlled and monitored from this station will be solar radiation effects and special test activities.
- **Biological control center.** Aerial or human subjects in the test space vehicle will have their various activities monitored by this post. For this function the center will be able to control the vehicle's internal pressure and temperature, depth levels, oxygen and shock characteristics and coordinate action for more ecological systems. Also installed will be psychological and physiological test controls. Physiology of data collected will include measurements of respiration, heart and brain activity, body temperature and blood pressure. The subject's physical experiences with respect to light, heating and response time also will be noted and charted here. Psychological safety reviews, collected, will depend upon communications and visual and television observations of the subject.
- **Propulsion system control center.** Nuclear engines, reaction, ion engines and auxiliary power source systems will be controlled from this station. Also monitored here will be thrust levels, temperature and pressure levels, mass flow, reaction gas values, and other reaction levels.
- **Guidance system center.** In addition to housing guidance system components, all controls, analog and digital, necessary to simulate characteristics of the vehicle and its equipment for simulating perturbations into the guidance system. This station also will control reference sources which will include radio frequency energy, infrared laser pointers, and visible positioning, orientation of guidance global support, and photometric representations.
- **Magnetic field control.** This station will operate the magnetic coils for static control of amplitude and direction of magnetic fields, and determine aspects of their dimensions.

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If America's first man-carrying rocket runs into trouble, a unique Donner device will play a vital role in bringing the Astronaut safely back to earth.

Known as a "manometer altitude sensor," the all-solid-state system is essentially a Ford periscope miniature analog computer housed in a manometer case only five inches long. Installed in the capsule it gives one action if it is necessary to abort the rocket flight before the Astronaut's escape tower is jettisoned.

What It Does

The Donner device, which was developed for McDonnell-Astronaut with the approval of NASA, provides programmed time delay that operates escape devices at manometer altitude.

Under abort conditions, the manometer altitude sensor provides output information which will:

1. Exercise devices for firing the explosion bolts holding the escape tower until the tip of the capsule. This allows the escape tower to separate.

2. Exercise the system which causes the escape tower within needed to fire. With the tower separated, parachutes are opened to open parachutes and jettison the Astronaut's capsule a safe distance.

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AERONAUTICAL ENGINEERING

British Study Wing Jets for STOL Uses

By John Tunstall

Lambda-New system of aerodynamic circulation control, for possible application in short takeoff and land aircraft, has been developed at the National Gas Turbine Establishment, Prestwick. The system is claimed to be an advance on the jet flap on which work first began eight years ago at Prestwick.

Based on model tests, using a 20% elliptical wing section, Dr. J. G. Chenevix-Town also leads the Prestwick team, told *Aeronautics Week* he hoped soon to demonstrate lift coefficients as high as 2.5 and lift/drag ratios on the order of 25.

The flow pattern can be arranged to eliminate wing stall under cruise conditions.

The technique is based on the use of slotted jet air impinged to the wing profile around the leading and trailing edges, which generate a circulatory flow pattern round the wing. The effect is to displace the rear stagnation point, which theoretically at least could be moved to unobstructed going maximum lift values.

Differential control of the slot flow provides a simple method of obtaining air-braked aerodynamic characteristics according to a chosen flight regime.

Main Advantage

Main advantage of the system over the jet flap, Chenevix-Town says, is the lower slope of the lift coefficient curve which renders the lift system less sensitive to gusts.

Prestwick technicians see the application of the system as the answer to the short takeoff and land air transport.

The most urgent approach to the leading and trailing problems, Chenevix-Town said, "is to reduce distances in a first step, rather than abolish them." Take-off and landing distances of typical jet transports could be halved with the Prestwick system, he added.

Results to date have been based on elliptical airfoil models, and on small elliptical wings with a single upper and lower slot only, 0.025 in. wide. A nine-chordwise and necessary length series of models is now being prepared with a multi-slot system at the rear and forward nose section of the wing, on which it is hoped to achieve coefficients more nearly approaching the theoretical maximum values predicted. The models currently being used have already demonstrated on the wind tunnel jet lift coefficients of three and the reduction of noise drag to zero.

British Ramjet Trials

Results of concept trials conducted last year by the National Gas Turbine Establishment using 26 in. dia. engines in rocket-fueled subsonic test vehicles reveal that the highest altitude achieved with any vehicle was 136,000 ft. In this case firing, the vehicle reached 79,000 ft in 46 sec before burning out and attained a speed at that point of Mach 2.39. The highest speed achieved in the test program was Mach 2.7. Typical speeds after starting, in rocket take-off mode about Mach 1.6.

Experience in this test program is believed to have substantially improved the performance of the British Ramjet.

Other trials work currently under way at the SAC engine development facility at Prestwick is centered on the development of a separate valve geometry.

Emphasis appeared centered on intake providing, which internal shock compression is used for creating supersonic flow, Mach 2 and on external internal compression intakes for higher cruise speeds. Installation incorporating need variable geometry features apparently has been developed in both categories but no details were obtainable.

The advantages of bypass engine ports to minimize effects of incidence on

pod drag and intake geometry also are under investigation.

Engine test facilities at Prestwick will soon be implemented in two further test cells, the first of which is considered in the British designs to be the most flexible of any known large test facilities. Costing \$75 million, and now nearing completion, the Prestwick No. 3 and will undertake sub-atmospheric testing up to 100,000 ft with full engine exhaust expansion, and accept any diameter engine on flight conditions demanded. Cell has a diameter of 20 ft and is 50 ft long.

Rapid Response

It will accommodate engine or turbojet engines with up to 500 lb sec. mass flow and can work with speeds up to Mach 2.8. Rapid response to intake temperature demands up to 600°C during an engine or flight program is obtained by the use of a large oil-fired air heater which has a heating capacity of 65-million lbs./hr. Intake temperatures down to -70°C are achieved by a 36,000 hp. air expansion/refrigeration system.

Prestwick technicians regard the compressor capabilities on the largest in the world for a single test cell. The compressor building houses eight compressor banks, each of which compresses 12,000 hp. controlled compressors in series driven by a 36,000 hp. electric motor. Total horsepower installed



Saunders-Roe Wasp Makes First Flight

Saunders-Roe Wasp, powered by a de Havilland Gnome radial engine, is shown on its test flight, piloted by M. M. Reed, chief test pilot. Gross engine produces 1,080 hp. Builders under test rate is similar to that on the P-51 Mustang 1 engine helicopter.



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amounts to 360,000 hp. Motors and components are supplied by General Electric Co., Ltd., and are usually to equipment supplied by the company to the steel industry.

Each compressor bank develops a pressure ratio of 8:1 and all the banks can be connected in series to give an overall ratio of 72:1. A ring air main connects the powerhouse of this cell to other test facilities on the site.

Early compressor data handling is a feature of the installation. All pressure, temperature, thrust, speed, fuel flow data, etc., is computed and then stored. Some data is computed continuously and up to an integrated channel may be placed back and processed graphically as the engine test proceeds. The remaining data is computed later and presented in reduced form, either type-setting, plotting or punched.

Results of other Fiatlock projects include a high vacuum method of joining turbine blades to the root, correlation of some levels (diesel) with atmospheric turbine, and the establishment of a relationship between the characteristic pattern of turbine data and strength and ductile characteristics.

The need to join a turbine blade to its root arose with increased turbofan. Fiatlock engineers developed an installation in which the bearing metal was introduced to the parent metal just as turbine under various test pressure conditions and high vacuum. The joint was then closed under vacuum. Joint tests showed tensile strength equal to the parent metal and an evidence of the interface occurred.

This led to a series of tests in which no bearing metal was used. These tests—called, Advance Wire formed, that the bearing metal made no contribution to the joint. The high pressure, high vacuum hot pressing process created sufficient conditions to create an intimate welding of the joint faces. The results of this latest work at Fiatlock may lead to the adoption of the joining process without bearing metal.

Virtually all air cooled turbine blades in service on United engines are extruded from round billets in which the air cooling holes have already been introduced as part of an earlier extruding operation. The billets are then forged or pressed into final shape and the holes drilled in the process to form the cooling matrix, properly located with respect to the temperature gradients in the blade.

Only the nature of the hole distribution is believed to distinguish the two types of blades in service. The die-cast blade has only three air-cooling holes spaced in multiplicity of very small holes, the latter providing the most efficient distribution, a factor of an increase such as much larger sized silicon engines.

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SMOKE SCREEN helps conceal a helicopter assault during Army's Exercise Fli Home at Yakima Firing Center, Wash.

Helicopters Demonstrate Assault Tactics

By Russell Howles

Yakima, Wash.—Helicopter assault teams in Exercise Fli Home at Strategic Arms Corps 4th Infantry Division base indicate that the helicopter has roles in land warfare, which apparently can not be filled by any of the new VTOL and STOVL concepts.

Only 94 Army helicopters and air planes could participate in the 15,000-man war games on and 750,000-acre Yakima Firing Center. The psychology and physical effects of helicopter home raids and vertical envelopments on an enemy were demonstrated repeatedly. Most of the Army aviation pulled and the helicopter is better suited to such attacks in, or close to the battle area than personnel helicopter, front-loader or conventional designs. The roles they see for the new designs in troop and cargo carries are in supply and troop movements over broadly terrain and in very deep penetrations to lightly defended landing areas.

Proposed Designs

Existing large aircraft are not well tailored to Army needs, according to Maj. Gen. Leon W. Thomas, commander of the 4th Division and deputy director of Exercise Fli Home. Large versions of the proposed designs could offer high speed cruise over long ranges and the ability to operate at unpopulated areas. Gen. Thomas said specialized aircraft, normally serving the Army, could present the type of risks the service suffered during the Lebanon crisis, when Army troops arrived late because of inadequate air transports.

Within a battle area the helicopter should prove more versatile and probably less vulnerable. To obtain tactical mission link-back on Avianco Wynn's office went with a helicopter-borne "approach" force, on a night assault to lead "U.S." forces. The tactical mobility of vertical envelopments and helicopter units is also largely in psychological effects on the enemy and the necessity of spending time and resources on the defense of his rear areas.

Helicopter Assault

The aggressive helicopter assault goes down three examples:

- **In the dark**, two assaulting units ambushed a single unit after a three-hour flight before morning separated them 15 percent successful, with actual bloodshed. Simulations of combat sometimes become too perfect.

- **Helicopter assault force** found and successfully destroyed road and airway building equipment of a combat support unit called upon to defend another place against helicopter-borne raiders who never came there.

- **Roadblock** was set up and for 15 min delayed the movement of resources to engage an attack coming southeast.

- **Two days later**, a commander of the defending force and carb reports had indicated that the assault force could number 500 men. To allow for multiple sightings and the surprise emergence of men under stress he discovered that in one-third and was reasonably confident that about 200 men were involved. Actually, there were only 90.

The weakness of helicopter attack against an entrenched force in action was 18, much less than could be expected in actual combat, but experienced officers said the results would

have nullified heavy losses. In the opinion of weapons and aviation observers the defenses needed well and the uncertainty and confusion produced were the least that could have been expected.

The shift of the assault force to obscure the defenses about its main location until the shooting started was due largely to the special vision of the helicopter and was probably enhanced by their distinctive noise and the precise time accuracy of evening lights. The approach light and departure from the troop landing areas were made through common sense and air river boats, much below the edge of blinds.

The Vertical H-21 troop carrier flew in a straight line-incoming formation. Each was airborne again within seconds of disembarking its assault troops and a steady stream of supply helicopter looped back, across the approach route, taking loadings and leaving to defend on like a new attack. Two Sikorski H-19 helicopters were used to make simultaneous descents in landing at various places, firing machine guns, and disrupting. The continued past of the attacking jets. Enemy occurred. A few of landing reports from south throughout its area. At least one was completely immune. Not even a discussion was made there.

Nearly defending units responded quickly, and supported by sending much-needed patrols into some of the reported landing areas, including the real one and the completely imaginary one.

Little was accomplished by the patrols because of the difficulty of finding the hidden and dispersed aggression in the dark.

Confronted by a strong attack on the



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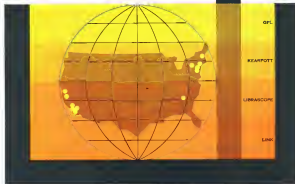
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Hydrieus the tortoise tells of a device system employed at the Siege of Alexander the Great and his Macedonian army crushed the Greek forces of Demetrius and reduced Greece to a dependent status for the remainder of classical antiquity. It consisted of a series of signal wares at which troops were displayed in combinations representing letters of the Greek alphabet. Although slow the system proved superior to the use of couriers.

Today, electronics and computer technology. Electronic communications make possible the immediate and continuing interchange of information and orders anywhere in the world. CCI is proud of its responsibilities in the design, development and manufacture of the advanced equipment required to measure and surface mine critical to our National Defense. CCI communications and data link equipment form an integral and most essential part in the new and vital ALIN (Airborne Long Range) program known as UHAWP, advanced early warning system in NATO's multinational defense network.



ELECTRONIC COMMUNICATIONS, INC.
55 PETERBURG, FLORIDA

Journal: *Journal of Interpersonal Violence*
Volume: 28 / Number: 10 / November 2013

ground Brig. Gen. William G. Blumford commanding the division during the maneuvers, decided he could not spare forces to find and destroy the assault helix daylight. The unarmored patrols were pulled in and air arm installations were buttoned up with defensive perimeter.

The risk is played by helicopters as the assault could have been played by landings. VTOL, strictly said, with difficulty, the helicopter pilot is assigned to cruise in the neighbourhood of the target, to wait for the order to have extremely heavy, dual, loadings and corresponding, high power requirements when the engines are used to produce vertical lift at very low speeds or while hovering. These high mass speeds cannot be used in tight approaches and the hovering engine produces a lot of torque for maintenance and protection against enemy fire is a lot part of Army air forces. With vertical thrust at low speeds, high fuel consumption would cut into the mission or range. Also, the helicopter is not very manoeuvrable, difficult to design, with the same low, manoeuvrability.

Ingestion Problems

In the powder volume dust found on the Yabara Ping Center and many principal contact theories the high downward velocities that go with heavy dust loadings would multiply maintenance problems caused by ingestion of foreign objects and abrasion of moving parts.

Simultaneous combat was not perfect in the helicopter operations, because some parabolic safety systems were taken. Anti-collision lights and the characteristic flapping sound of rotors are useful tools to enhance and distinguish risk factors, but certainly not a full one.

An automatic weapon or missile belt
may with a clear field of fire can easily
shoot down a helicopter.

The strongest formatist used in *Escape 2D* here creates an impression of large numbers, but might not be a good idea in actual combat because of the time it gives an enemy to bring weapons to bear as the approach occurs and shoot down the last helicopter in the string.

While Arrow plans are expert at negotiating on paper, screen for protection against more fire arms war are fought in the field. Even in mountain there is a high probability of firing over a different position after the approach move. These are tactics for dealing with these situations. Smoke and dust can be used for concealment and firepower can be used to make the enemy from behind. Also

Missile and gun carrying helicopters being developed by Army should prove to be the last tools for amphibious



GE Tests CF700; Announces CJ610 Light Turbojet

[illegible]

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combined with excellent resistance to corrosion.

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It's jam-packed with data. For your free copy, see your A-L representative or write **Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa. Address Dept. AW-6.**

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caution far from position close to the approach route because of their ability to shut off the troop column.

Suggest he either on flight-barb or on USARF Tactical Air Command calls for close coordination. The troop-carrying helicopters follow a strat flight plan to the close behind a safety net which advances along the approach route according to an afloat start schedule and is closed by either command and forward air controllers. Local air superiority is virtually a necessity for vertical envelopment operations.

Army studies often flying in the mountains and the service would use fixed wing VTOL airplanes differently than helicopters. They explain that the variety of services which recruit can perform for an area is so great that even specialized designs are needed. The fixed wing VTOL and STOL designs allow the speed and range which troops carry, such as an airplane would be capable of much deeper penetrations that would produce a corresponding more widespread effect in combat.

Shallow envelopment and close to the battle area can produce more intense effects on the enemy within a smaller radius. A mix of troops and troop-carrying helicopters seems best for these to most of the Army studies who were asked.

Price of Versatility

Army studies must pay a price for the versatility it needs. To support a variety of aircraft, the service must construct units do with fewer of a given type than it ought to have. Tight funding contributes to the problem.

A personnel division has agreed to it a single aviation company to provide basic transportation, by helicopter, war, spot action fire, various small



Army Caribou Operates From Dirt Strip

Air view shows Army's AC-119 Caribou on dirt strip. The cargo aircraft, built by de Havilland of Canada, can carry 24 fully-equipped cargo troops or 6,000 lbs. of cargo. Range is 300 mi maximum operating speed tops at 70-100 mph.

troops, combat biological services, electronic warfare communications, etc. usually control troop movements on the ground, etc. An officer of the 4th Aviation Company, which serves the 4th Infantry Division, estimates that a personnel division in combat really needs two or three times the original number it has.

To get maximum utility from its aircraft, the Army keeps specialized units with a single type of aircraft at the corps level or higher. These can be ordered where they are needed most.

The aggressive assault on K. Here was done by the 57th Transportation Company (helicopter), attached to the 4th Division especially for the mission. With 50% of the total 1121 helicopters available, such a company is capable of supplying one of the five battalions in a personnel division

continuously with everything except fuel for the battalions' vehicles, if the battle group is no more than 50 mi from the source of supply. A narrow road column must still depend on an "lead tail" for fuel. The 80% availability level enables the transportation company to supply an infantry company up to 50 mi, evacuate 10% wounded in one lift or carry 33 % of best of equipment.

Given essential supply of spare parts and reasonable luck, a helicopter transportation company can keep in operation 80% availability for three weeks in the field. Field maintenance when current time with serious repairs to some key assemblies such as transmissions, rotor hubs, etc., and not much sheet metal work can be done forward of the base camp level.

It seemed to most military observers



First Photo Shows Gloster Javelin's In-Flight Refueling Boom

Gloster Javelin equipped with an in-flight refueling probe is shown for first time. Note meters positioned slightly off of leading edge on outer portion of wing. Gloster is conducting a major modification program of Mk. VII Javelins (AW 511 21 p. 44).

KNOW YOUR ALLOY STEELS . . .

This is one of a series of advertisements dealing with heat-treating alloy steels. Though much of the information is elementary, we believe it will be of value to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.

Normalizing Alloy Steels

There are several forms of heat-treatment commonly employed in the processing of alloy steels. Each in its own way modifies the mechanical properties and structures of steel, and each is chosen with a definite objective in mind. The five usual forms of treatment are normalizing, annealing, spheroidizing, annealing, quenching and tempering, and stress-relieving.

In this particular discussion, let us consider briefly the purposes and effects of normalizing.

Normalizing is an operation in which the steel is heated to approximately 100 deg F above the upper transformation range, then cooled in still or agitated air. The basic purpose is to refine the prior structure produced by variations in finishing temperatures encountered in rolling or forging. The structure resulting from normalizing, being more uniform, will help create improved mechanical properties when the steel is subsequently reheated, liquid-quenched, and tempered.

There are times when large steel parts (heavy forgings, for example) cannot be liquid-quenched because of their size. In cases of this nature, the heat-treatment must consist of single or multiple normalizing followed by tempering.

High-temperature normalizing is sometimes used for grain-coarsening

low-carbon alloy steels to promote machinability. (In high-temperature normalizing, steel is heated to more than 100 deg F above the upper transformation range.) At times it is possible to machine a steel in the air-cooled condition, the governing factor being the alloy content. However, the highly alloyed steels may require annealing or tempering after normalizing, to decrease the hardness.

It is essential, when normalizing is employed, that free circulation of still or agitated air be provided. When air-cooling of individual bars or forgings is not practicable, the furnace charge should provide for some means of separation, such as racks or spacers.

If you would care to know more about normalizing, or any other phase of heat treating, you are invited to consult with Bethlehem metallurgists. They are always glad to give you any help you need.

And remember that Bethlehem makes the full range of AISI standard alloy steels, as well as special alloy steels and all carbon grades.

This series of alloy steel advertisements is now available as a compact booklet, "Quick Facts about Alloy Steels." If you would like a free copy, please address your request to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.

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BETHLEHEM STEEL



scissors for the present competition "since we have no analogous clips with which to try it."

Adin Jones and another firm from waterlogged facilities, were invited to compete directly, those without such facilities to enter as a team best with shopholders.

"I am sure," he said, "that we ship-builders, both small and commercial, can learn a great deal more from an on-site demonstration, especially about lightweight frames, engines, structural members." He added that the Bureau of Ships also is encouraging private shipbuilders "to get an injection of aircraft-type experience and use it."

He told the subcommittee that "a great deal of work" remains to be done before Navy can go to hydrotest vessels of 200 tons or more, "and we expect to get some assistance, directly or indirectly, from the aircraft industry."

Problems to be overcome, Adin Jones said, include means of cutting down hull and casement weight, strengthening deck structural members and increasing propulsion efficiency as well as "a lot more information on superheating fuels."

PRODUCTION BRIEFING

British Aircraft Corp., group formed by merger of English Electric, Vickers-Armstrongs and Bristol Aircraft, has reached agreement for acquisition of controlling interest in Hawking Aircraft, Ltd. British Aircraft Corp. will be headed by Lord Portal of Hungerford, former chairman of British Aircraft, Ltd. Corporation is capitalized at \$70 million, \$52.4 million cash provided by English Electric and Vickers, and \$17.6 million by Bristol.

Avco Aircraft of Ann Arbor has ordered an Max Huter Super Remounted turboprop instrument an replacement for its Douglas DC-15. Super Remounted is priced by two Turboprop Turbine Engines delivering 1,900 hp each. Part Super Remounted is scheduled to be by the end of June, order so far total 25.

Slack Aircraft announced recently that it has signed a definitive purchase agreement with Canadian Ltd., for the purchase of two CL-440 turboprop aircraft, with options on four more. The contract for over \$9 million calls for delivery of the first swing-tail aircraft in September, 1965, the second in October, 1965. The remaining four optional CL-440s are scheduled for delivery in 1967. Slack made a down payment of \$500,000 at the signing of the contract. Slack officials said the CL-440s operating rate of approximately four cents per hr. mile will enable Slack to lower cargo rates.

CONTINENTAL AIRCRAFT ENGINES

POWER MORE UTILITY PLANES
THAN ALL OTHER ENGINES COMBINED

20 MODELS—60 TO 240 HORSEPOWER

MODEL	HP	WPL	CYL	WGT	OUTPUT
A-10	65	3200	6	172	2000
C-10	105	3600	6	200	2400
C-100-A, B & C	100	3700	6	190	2400
C-1000-C	140	3700	6	277	2600
C-1000-D	150	3700	6	312	2600
C-1000-E	210	3800	6	363	2600
C-1000-F	220	3800	6	404	2600
C-1000-G	240	3800	6	424	2600
C-1000-H	260	3800	6	470	2600
C-1000-I	270	3800	6	480	2600
C-1000-J	280	3800	6	490	2600
C-1000-K	290	3800	6	500	2600
C-1000-L	300	3800	6	510	2600
C-1000-M	310	3800	6	520	2600
C-1000-N	320	3800	6	530	2600
C-1000-O	330	3800	6	540	2600
C-1000-P	340	3800	6	550	2600
C-1000-Q	350	3800	6	560	2600
C-1000-R	360	3800	6	570	2600
C-1000-S	370	3800	6	580	2600
C-1000-T	380	3800	6	590	2600
C-1000-U	390	3800	6	600	2600
C-1000-V	400	3800	6	610	2600
C-1000-W	410	3800	6	620	2600
C-1000-X	420	3800	6	630	2600
C-1000-Y	430	3800	6	640	2600
C-1000-Z	440	3800	6	650	2600

*Weights—maximum take-off weight (gross weight)

*Outputs—maximum continuous power (gross)

*Outputs—maximum continuous power (gross)

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*Outputs—maximum continuous power (gross)



EDGEWISE METER

Large, easily read dialing 11" scale in only 10 x 10" panel gives the EdgeWise a virtual measuring function, with standard 1000 scale markings, two readings and readability of larger increments. Weight 17 lb. Supplied with combination measuring bracket and base (not shown). Bids on request. Marion Instrument Division, Marionville Manufacturing Corporation, Marionville, Mo. 64659, U.S.A. or Canada. (Marionville Corporation Limited, Toronto, Ontario, Canada).

Honeywell

7000 Series **TECHNOLOGY THE FUTURE** **First in Control**



Douglas RF-66 of 15th AF's 15th Tactical Reconnaissance Wing trades on wing during filling of its liquid oxygen system (LOX) part of servicing routine done during daylight hours of Round Photo Fire exercise. Photo also was taken in long range night mission.

Tactical Teams Compete in Photo-Recon Event



English Electric Canberra PB-1 takes on a daylight photo mission. Canberra team of Second AFAF wing the daylight contest but lost night mission to the RF-66.

Photo reconnaissance teams of the Fourth Allied Tactical Air Force scored one each of the Second AFAF in the Round Photo Fire. The second NAFRO team reconnaissance exercise staged at Basingstoke, Gosport (AW May 30, p. 56). Fourth AFAF teams were from France and U.S. units. Second Allied teams from Belgium, British and Dutch squadrons. Canadian and West German were observers at the exercise; both nations' commands have tasks in the night in NAFRO's previous efforts. West German plus its reconnaissance capability in night photo. First among was based on the excellent performance of jobs, aircraft, command and ground indication. "All" reports were made by photo interceptors working with net interceptors. Reports at night have information, size and type of target, its capabilities, direction and other data needed in planning an immediate strike.



French air force Republic RF-54F flies off from base leaving 150 area Basingstoke (left). French team won the short range contest and ranked up target from wing during the event. At right a Netherlands air force RF-54F team used to start a photo team during Round Photo Fire. Dutch team from 15th AF's McDonnell Douglas in common range mission.



One of five McDonnell RF-101C Phantom II's of 66th Tactical Reconnaissance Wing team to retirement after a mission.



Vickers-Supermarine Swift FB-5 of Royal Air Force's No. 79 Squadron, is refueled for a short range mission during Round Photo Fire. Below, RAF interceptors circle around a Swift, indicating suggestions from the plane's nose and left-logic camera.



THIS NEW 2-CHANNEL DIRECT WRITER...



SANBORN Model 297 Oscillographic Recorder

Computations and recording without loss in performance is the design goal for this new 2-Channel Direct-Writer from Sanborn. The Model 297 provides two complete recording channels in only 18 1/2" of panel space, making it especially useful as a computing recorder — equipped with large instrumentation signals or data processing capabilities, long scale and smaller equipment. In its own portable case, the Model 297 will be especially useful in laboratory and field applications as a bench-top instrument.

Pen/pencil/ink are "RS" Series plug-in interchangeable units, available in Current, DC Coupled, Phase Inverted, Derivative, and Low Level types. They may be used in any combination, one for each channel. An optional MOPA for carrier free cheaper operation is also available.

The basic recorder assembly houses a pen/pencil power supply, two independent power-trip for power supply, low line impedance output-feedback power amplifiers with feedback electrical limiter that provides damping at all times. This entire unit has built-in forced air cooling.

The recording mechanism has rugged, isolated, synchronous with velocity feedback damping... a 4 channel chart speed selected by switch between 1000/rev/min or 1000/rev/min with a manual drive... approximately 1/1000 of an inch short with remarkably small space made by hand style. The electrical and me-

* has easily read 50 mm wide, rectangular coordinate channels

* mounts in 18 1/2" of rack space or in a separate portable case

* interchangeable "RS" Series plug-in pen/pencil/ink for each channel

chanical and electrical in combination with the easy "plug-in" operating features make the compact Model 297 one of the most useful, reliable 2-channel direct writers available.

Contact the Sanborn Sales-Engineering representatives nearest you or write the main office at Watford for complete information and application assistance. Sales-Engineering representatives are located in grouped cities throughout the United States, Canada and foreign countries.

Model 297 2-Channel Recording System Specifications

Form plus in catalog
Sensitivity: 1.2 volt/cm nominal
Frequency Response: 50 cps to 100 cps within 3 db, 40 cps to 100 cps outside
Gain Linearity: Flatline Error 1% from 200 to 4000 cps at 100 volt/cm
Linearity Error: less than 0.01% at 100 cps
Electrical Loading: Approximately 500 ohms of load (with 100 ohm input impedance)
Dimensions: 18 1/2" high x 32" deep x 22" wide
Paper Take up: completely automatic

(Specifications are subject to change without notice)

SANBORN COMPANY

Industrial Division
172 Wynton Street, Watford, MA, 02154-0025

AVIONICS

Ceramic Gyroscope Uses Gas Bearings

By Philip J. Khan

Manchester, Mass.—New sensitive integrating gyro that uses a spinning rotor made of ceramic supported on gas bearings, which cuts gas drift rate by a factor of 10:1, has been developed here by Honeywell International Automatic Division. Improved accuracy is based on measurements made on a limited number of prototype units.

Specific drift rates as not reported by Honeywell. However, a 16:1 reduction in drift rate would put the gas drift at the order of 0.0005 to 0.001 deg/hr. Vibration, or bearing noise, has been studied by a factor of 30:1, Honeywell says.

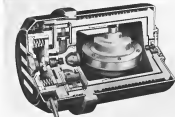
New Honeywell gyro measures 2.5 in. in diameter, is 2.75 in. long and weighs slightly less than 0.7 lb. It also has an angular momentum of 150,000 gram-centimeters squared per second. High accuracy samples will be available for this year with full production starting early next year, company says.

Honeywell is the first to disclose a ceramic rotor gyro, but the use of no bearings to support the spinning rotor is a technique that has been employed previously by North American's Autonics Division.

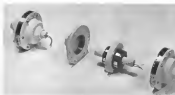
Although ball bearing quality and uniformity has improved greatly in recent years, the demands placed upon gyros have grown more difficult. One reason is the improved accuracy needed for long-range ballistic missiles. Another is the requirement for long life in size size for missiles such as the Nike-X missile, where the gyro will be subjected to frequent operational checks over a period of several years.

The gas bearing offers a nearly frictionless support and reduces the space on impact that can result from a slight shift of balls or rollers in mechanical bearings. With the gas bearing, the spinning rotor is supported on a thin film of gas, such as helium or air, which measures only 25 millionths of an inch thick, in the case of the Honeywell gyro.

Because a diameter of only 25 millionths of an inch between gas gaps normally requires a precision to make them, if the gyro rotor is to be able to spin freely at a speed of 12,000 rpm, there must be a near-perfect finish between the rotors and the external frame which the rotor and its supports are made must have extremely high dimensional stability. Further the material must be extremely hard so that



CERAMIC GYRO, which uses gas bearings instead of ball bearings for spinning rotor, reportedly has only 1/10th the drift rate of conventional sensitive integrating gyros. New ceramic gas-bearing gyro, developed by Honeywell, weighs only 0.6 lb.



CERAMIC ROTOR ASSEMBLY, shown disassembled shows rotors' deflection resistance. Metal base made ceramic rotor provides rotational torque while external metal band provides support rotor base. New design cuts bearing noise by 30:1, Honeywell says.

there will be no significant wear during starting and stopping operations when there is no cushion of gas to support the rotating mass.

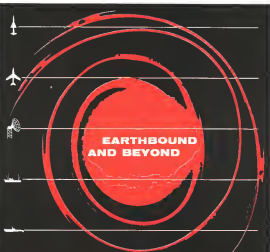
The constant used in Honeywell's new gyro, next it has been used and first at a temperature of 1,500°F, as well as at higher and lower temperatures. Another feature of the ceramic construction is that hydrocarbon and even oil can be used to completely clean the assembly of sub-microscopic particles that would adversely affect gyro performance.

The new gyro rotor consists of two ceramic lobes that are bolted to a

metal base with high dimensional stability. Over a temperature range of -55°F to 1,500°F, it retains its mechanical dimensions to within two millionths of an inch.

Another feature of the ceramic construction is that hydrocarbon and even oil can be used to completely clean the assembly of sub-microscopic particles that would adversely affect gyro performance.

The new gyro rotor consists of two ceramic lobes that are bolted to a



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Cannon's complete line of RF coaxial plugs meet the exacting demands of today's technology with room to spare! Whichever coaxial cable is used, bent, sex, air, or extra space, Cannon's RF plugs—standard, miniature, and light-weight miniature—provide the exact type and size for any application...whether airborne or military. Aircraft • Missiles • Ground Support Equipment • Ships • Submarines • Wide for literature for

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SMALL SIZE of Haneswell's new contact gyroscopic gas rotor is shown above.

acquired mass for gyroscopic action. The rotor spins about a rotor combining two field windings inside each of the contact hubs in a laminated hydrogen ring which develops torque that causes the rotor to spin.

The contact rotor is supported inside

the vacuum chamber with a clearance of about 168 millionths of an inch and the grid is filled with helium, nitrogen or other gas and sealed. (Present models are at a pressure of one atmosphere, but Haneswell is experimenting with higher pressure fills.) The contact grid assembly is mounted in a liquid and restrained by powered pivots, with packoffs and torque rods, much like a conventional integrating gyro.

When the gyro is started by applying an a.c. voltage to the stator field winding, the rotor, which has been in physical contact with the grid and the stator shaft because there is no cushion of air, begins to rotate. Small grooves inside the rotor hubs act like vanes to generate a flow of air between the spinning rotor and the stator shaft and the grid.

To give a feeling for the closeness of the fit between the rotor and the stator shaft, if a workman were to handle the shaft before the rotor were placed on it, the thickness of the film added by the workman's fingerprint would be enough to prevent the rotor from turning unless voltage was applied, according to Mathew Haneswell, project engineer in Haneswell's advanced guided gyro group.

Beyond the hardware and dimensional stability which a ceramic rotor



Atlas Airborne Command Guidance System

Four photos of airborne portions of Atlas radio-command guidance system, used for most 9,000 sq. miles and for 32 out of 34 missile-borne Atlas flights made since last July from Atlantic Missile Range. The General Electric developed guidance system includes tracking beacon (black box, upper right), data command system (black display), rate beacon (black instrument) and decoder (black box to left of instrument). Tracking beacon and decoder convert command signals received via ground tracking radar into steering commands for Atlas autopilot. Rate beacon is used to establish missile's velocity by means of doppler shift to determine engine thrust point.

THE PROBLEM:
Development of a new, highly reliable rocket propulsive system

IN FINDING A SOLUTION:

2 HEADS ARE BETTER THAN 1

BUT ARE...

4 BETTER THAN 2?

8 BETTER THAN 4?

16 BETTER THAN 8?

32 BETTER THAN 16?

64 BETTER THAN 32?

128 BETTER THAN 64?

At United Technology Corporation, the old adage—"Two heads are better than one"—is closed with respect.

But it also is recognized that at some point, too many can cause excessive administrative cost, confusion, and red tape which increases the difficulty of finding the solution to the original technical problem.

The philosophy—corporate philosophy—at United Technology Corporation, therefore, is an equality—equality of mind, talent and experience, rather than an sheer numbers of people. This approach permits the maximum percentage of scientific and engineering men hours to be devoted to the analyses and experimentation required to obtain the best answers to the technical problems at hand.



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FIRST TO MEET MS 21042 AND NAS 1291

SPS FN-12 Featherweight locknut replaces NAS 679 and equivalents*—saves up to 72% in locknut weight



SPS FN-12 Series Featherweight locknut was the first to meet new MS 21042 calling for a lighter weight, square steel for NAS 679 sheet metal nuts. SPS locknut weighs only major weight, savings, customer confirms since high reliability with proven technology, reduces through use of proven testing theory.

Here is the only nut series that meets the new MS 21042 standard, calling for a lighter weight locknut than one previously replaced the heavier type AN 283, MS 2084, MS 2085 and MS 21048 Series.

The new SPS FN-12 weighs as much as 60% less than NAS 679 sheet metal nuts and counterparts . . . up to 70% less than equivalent MS or AN types *

The FN-12 saves weight in another way also. Because of its new configuration, it can be installed easier in various applications than any other screw nut now in use. This allows a turner to follow SPS, with consequent reduction in aircraft weight.

You can specify FN-12 Series Featherweight locknuts in 11 sizes. All are available for immediate delivery—you get what you order without delay. And all sizes of the FN-12 locknut—0.0 through 1/2 in.—are lower in price than the NAS 679 locknut.

For more information, write SPS—manufacturer of precision threaded fasteners and allied products in many metals, including titanium. Request Bulletin 2435.

AIRCRAFT/MISSILE Division

JENKINTOWN 3, PENNSYLVANIA
SANTA ANA, CALIFORNIA

SPS

where reliability replaces probability

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and ground provide, Honeywell has come up with other good applications where use of ceramic pays off.

Construction of the state-of-the-art engine is a couple. Instead of using the conventional open ring to seal in the oil, Honeywell employs thin rings of ceramic. The thin rings are made with ceramic coated wire instead of the steel coated or spray coated. When the state has been assembled, it is fired into what amounts to a ceramic encapsulated subassembly. (Ceramic is inherently resistant to heat and is a self-healing material.)

The next order provides a more rugged construction, but gives the motor a fulling for greater dimensional stability at engine temperatures. It also prevents use of oil and for cleaning the entire oil of contaminants particles.

Ceramic rings are ground to approximate size while in a "half-fused" state; then polished ground to final dimensions and finished using diamond compounds.

Honeywell uses its new ceramic gas seal without shims of 10g without bottoming when gas rotor is spinning at 10,000 rpm for 100,000 and 100,000 rpm.

Despite the engine's greater accuracy, Honeywell believes that it will sell for approximately the same price as a conventional turbine engine. The reason is that the engine is in full production. Initial engineering samples, however, will be about expensive. Company spokesmen say the ceramic gas seal is available now even less than one using conventional construction because of its inherent in assembly procedures.

The new ceramic construction and gas bearing techniques are expected to have the basis of a new family of gas at Honeywell. Current work there is new ground support techniques aimed at reducing further source of gas error, should produce higher accuracy, even in the future, a spokesman indicates.

Michigan Offers Courses In Oscillators, Amplifiers

Two consecutive one week courses in solid state microwave amplifiers and oscillators, including theory, design and practical experience, are being offered by the University of Michigan during the last two weeks in July. Staff for the courses will include members of the university staff represented by Benjamin Lee and James M. Lewis, Laboratory, Nucleonics, Michigan State University, E. Schuchman, Bell Telephone Laboratories and Mrs. Wm. Hughes Aircraft Research Laboratories. Requests for information regarding registration should be addressed to George Mathews, Bldg. 41, Willow Run Laboratories, Ann Arbor, Mich.

Soon-From This New Shop

Jet Engines



Overhauled by Airwork

By the time you read this, machine tools will be moving into the new shop and most of our lead men will have had their training in the Holt-Reynolds factory. By early July, we will be overhauling Dart engines.

This shop, and its three related additions to our Millville plant, are designed to produce jet engine overhauls to the highest precision standards. We are constructing a dynamometer-type test cell to provide the most accurate pre-flight test of engine conditions available, independent of varying atmospheric conditions.

At the same time, a new 13,000 square foot addition to our Miami Jet Accessory Overhaul Shop has been completed, more than doubling the available working area.

When you need a top quality jet engine or accessory overhaul, Airwork will be ready to serve you . . . with the extra quality that is part of our aviation tradition.



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Day by day the Polaris missile gets nearer to its first submarine test firing. As near the day when, operational, it will become one of our nation's most formidable deterrents to aggression. For with submarines serving as mobile missile launching pads, any target on earth is within deadly striking range if retaliation becomes necessary.

The Polaris-launching submarines are splendidly fitted out not only to aim and fire and accurately guide the missile, but also to defend themselves. Advanced Sperry submarine equipment contributes to both these functions. For passive navigation there is SINS (Ship's Inertial Navigation System), automatic steering and stabilization, depth detection, gyro-

compass, diving and maneuvering controls, instrumentation, and computers. And the NAVDAC computer which coordinates all navigation data. For anti-submarine warfare the calm have Sperry corporate fire control systems, sonar and detection equipment, the attack periscope stuff. At two special laboratories both aspects of the Polaris program are being refined and integrated: one of which simulates submarine navigation the other the environments of the sea.

Sperry's role in the Polaris program is typical of the Company today, achieving through specialized divisions an integrated capability that is contributing to every major arena of our civilization. General office: Great Neck, N. Y.



SPERRY
ANALOG DIVISION



INERTIAL GUIDANCE SYSTEM (left) single 14.5 lb. Avco/RCA micromodules for stabilized platform amplifiers. (Right) photo shows two probe amplifiers of conventional modular construction (left) and two of micromodules construction (right).



INERTIAL GUIDANCE COMPUTERS (left) show Avco/RCA Corp. of Avco micromodules. Complete guidance computer, including sensors, weighs only 4 lb. Photo at right shows egg-crate construction of digital computer. Micromodules slip into compartment cover having corrugated metal frame which provides shock isolation and serves as heat sink.



Inertial System Contains Micromodules

Burlington, Mass.-A complete inertial guidance/navigation system which weighs less than 45 lb.—only 50% to 66% the weight of systems with comparable performance—has been developed here by Radio Corp. of America's Naval Electronics and Controls Division. A four-gimbaled platform system weighs about 14½ lb., a three-gimbal local inertial weight about 5 lb. less.

RCA has been able to shed the weight, size and power consumption of its new inertial system through the use of micromodules developed by the company under Avco sponsorship. This marks the first use of micromodules in equipment intended for missile application.

The RCA system, now undergoing test, is expected to provide a missile error probability (CEP) of one meter in one hour when used on its approach that lies at 550 mi., or 0.1% of total

range when used in a ballistic mode, the company says.

The complete system, including platform, computer, power supply and cockpit display, occupies 0.62 cu. ft. and consumes 33.5 watts of electric power.

Micromodule Features

The most novel features of the RCA system are found in the micromodule construction of the digital computer and the stabilized platform amplifiers and control circuitry. The design of the platform is comparable to conventional computers, constructed from micro-

The complete navigation guidance computer, constructed from micro-modules, employing a ferrite core system, occupies a volume of only 0.95 cu. ft. and weighs 4 lb. Power consumption is 12½ watts. The micromodules are mounted in a metal frame which resembles an egg-crate, then added to a printed-circuit backplate. Two such

frames, each accommodating 110 micromodules, make up the computer sub-system unit.

Each micromodule is surrounded by a corrugated metal shell which serves both as a shock isolator and as a means for transferring heat from the module to metal bars and then to the frame which serves as a heat sink. To facilitate replacement of a defective module, RCA has developed a small fixture which makes it advisable even to unsolder module leads from the backplate, after which it can be dipped from the egg-crate frame.

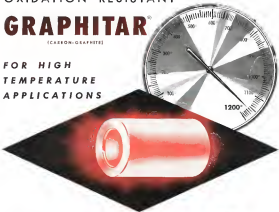
In contrast the amplifiers and control circuitry required for platform stabilization directly on the inertial gimbal, it weighs about one half the weight of designs that would be needed if amplifiers were external to the platform. Signals which must be transmitted to the external computer can be amplified

ANNOUNCING A NEW OXIDATION RESISTANT

GRAPHITAR®

(CARBON-GRAPHITE)

FOR HIGH
TEMPERATURE
APPLICATIONS



Calculating five years of extensive research, engineers of The United States Graphite Company have developed a new oxidation resistant GRAPHITAR. In successive tests, GRAPHITAR parts were exposed in an oxidizing atmosphere (air) at 1200 degrees F and after 200 hours, the GRAPHITAR showed a weight loss of less than one percent!

GRAPHITAR, which is available in many grades, is a versatile engineering material with unusual and outstanding properties that make it ideal for tough applications. It is non-toxic, meets chemical attack, has self-lubricating properties and a low coefficient of friction. It is mechanically strong, lighter than magnesium and is the perfect material for packing rings, piston ring seals, clutch release bearings, dead coupling seals, piston rings, pump liners and valves.

For more information on this new oxidation resistant GRAPHITAR and its applications, write the GRAPHITAR product manager at your company letterhead.



8371

THE UNITED STATES GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW 5, MICHIGAN

GRAPHITAR® CARBON-GRAPHITE • GRAMITE® PURIFIER METALLOGY • MEXICAN® GRAPHITE PRODUCTS • WGO® BRONZE

before passing through the dipper to greatly reduce the problem of strip pickup.

The amplifiers required for all three sets of the platform, plus temperature controls, are built into a micromodule assembly which weighs 11 lb and costs just \$841 ex. ft. Total assembly can be quickly replaced for maintenance.

The basic design and amplifier design were developed by RCA's Visible Electronics and Controls Division here, using noncritical components and construction. These designs were then turned over to the company's Semiconductor and Materials Division, Smyrna, N. J., which developed the equivalent micromodule circuitry and elements.

The steelball platform is available in either a three-pedal configuration, weighing 293 lb, or a four-pedal design which weighs 248 lb, excluding the 14 lb of gaged mounted stainless. Platform pressure is designed to test Minneapolis-Honeywell or Krautkopf resistance integrating gages, with an input resistance of the order of 5 x 10¹⁰ ohms-ohm-ohm squared per volt and, but can be adapted to other gage designs RCA says.

Percent platform design employs three Kierulff actuated pendulum type accelerometers in which displacement of the seismic mass by an applied acceleration produces a pickup signal which is amplified, then applied to a torque coil in the accelerometer to return mass to its original position. When the accelerometer is rolled out, the torque coil of the current flowing through the torque coil is a direct function of the applied acceleration and therefore can be used as an output signal.

For applications where an integrating accelerometer or digital output is desired, a gating technique can be used to produce the required torque on the accelerometer mass. The accelerometer pickup signal drives a pulse-producing circuit and the number of pulses required to roll out the mass is a direct measure of the integral of acceleration, i.e., velocity.

The platform employs dual-drive, torque motors rather than servo motors and gearing. Passive type systems are used to pick off deflection angles of the inertial gimbals relative to the sensitive temperature stabilization of the gage is accomplished by cooling down a lensing with an internal blower motor and using thermoelectrically controlled valves to regulate the temperature of the circulating air.

RCA, which developed the new, uncondemned neutral system with company funds, currently is showing the system to prospective customers. Company spokesmen say at least one specific application is an aircraft project.



Only the New
Cherrylock
Aircraft Rivets
Give you ALL
these advantages...

- ★ Positive Mechanically Locked Stem
- ★ Flush Fracture (No Stem Trimming)
- ★ Strong Clinch
- ★ Wide Grip Range
- ★ Positive Hole Fill

The Cherrylock® "2000" Series Locked Stem Rivet offers every feature desired in an aircraft blind rivet...proven high sheet clamp-up with no stem trimming (fracture flush on installation), uniform head seating, complete hole-fill, wide grip range, and positive mechanically locked stem.

Fast, economical, easy installation (with no stem trimming) is available with Cherrylock rivets, using existing Cherry installation guns. You get better fastening at lower installed cost.

One rivet can be used for several material thicknesses, reducing stock requirements and lowering costs. Positive hole-fill, even in oversized holes, simplifies preparation problems to further reduce installation costs. Available in:

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Electronics: key to the secret sea.



The problems posed in developing an effective Anti-Submarine Warfare System require the development of entirely new concepts in the broad field of electronics.

Applying electronic skills toward each of the many elements of the problem is only part of the job. The real key is in the integration of these elements into total systems that effectively solve the problems of ASW.

Working with the Navy, Hughes has instituted a complete systems analysis or "information environment" approach. This Hughes "sys-

This simulated Navy Coastal Information Center uses Hughes advanced information and display systems to scan hundreds of points of surveillance data into a meaningful total.



tem orientation" draws upon unique abilities acquired in the development of such Hughes systems as: airborne electronic armament systems, which can control an entire mission; 3-dimensional radar systems, which constitute the most important advance in the state of the art since radar itself was invented; Falcon guided missiles, which are the most advanced weapons of their type—just to name a few.

Rather than taking standard approaches to the ASW problem, Hughes engineers are using a wide variety of electronic disciplines. Studies presently underway include: research in acoustic array systems (both fixed and mobile); radar and IR detection systems; magnetic anomaly detection systems; information, command and controls systems for strategic decision-making and for tactical operations; communications systems; signal recovery techniques; human factors studies.

Forecast, imagination, tested and proven management capability—these are the factors which insure successful Hughes systems implementation. For further information concerning the Hughes "information-environment" approach, please contact: Mr. D. E. Heelmer, Undersea Warfare Mission Coordinator, Hughes Aircraft Co., Fullerton, California.

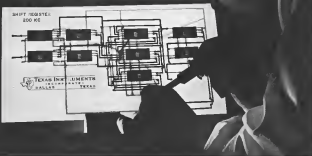
To study ultrasonics/infrared systems for ASW, Hughes engineers have developed this prototype miniature super refrigeration which cools sensitive elements to temperatures as low as -250°C .



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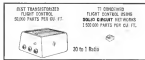
In 1955, five years ahead of industry expectations, Texas Instruments introduced Solid Circuit semiconductor networks—a new concept for harnessing the functions of a complete circuit in a single crystal silicon wafer no larger than the head of a match.

Now, system designers in TI's Apparatus Division are applying this concept to digital flight control problems—and the result is minimum 30-to-one size reduction over the highest-density packaging previously available. Equally important is an 80% reduction in the number of solder joints—a major cause of electronic equipment failures. Apparatus Division experience in this new concept indicates that nearly half of today's military electronics, ground or airborne systems, can make practical, beneficial use of Solid Circuit networks.

Other reliability gains attributed to this new design concept arise from simplified production, test and process control. Equipment fabrication steps already have been reduced to one-fourth those needed for the same circuit functions using conventional components. Where accelerated long-term reliability is required such as in space flight, the weight

and space consumed by conventional components can now be devoted to circuit redundancy and "self-healing" techniques. And in tank/space vehicle designs these new space and weight savings mean that fuel load can be increased without displacing valuable instrumentation.

The application of this advanced technology is another example showing how TI puts new concepts to work in military electronic systems. For more information on TI capabilities, send for booklet "Missile Electronic Systems" or contact SERVICE ENGINEERING.



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APPARATUS DIVISION

Interest Grows in Cryogenic Techniques

By Barry Miller

Washington—Interest in cryogenic techniques, especially thin superconducting films, for computing systems appears to be on the upswing. A recent two-day symposium held here on the topic indicates.

Sponsored by the Information Systems Branch of the Office of Naval Research, the meeting brought together about 400 scientists and engineers from the country and abroad for an exchange of views on the technical status and problems of superconductivity, and to discuss design, other cryogenic technology and devices which have applications in information processing systems.

Superconducting Devices

Superconducting devices for computing systems are enjoying a modest revival, a number of speakers attending the symposium told *Aviation Week*.

After an initial burst of activity earlier this year, stimulated by the late Dudley Buck's suggestion for the computer—a small low-power superconductive switch—interest in these devices dwindled.

A few major companies, however, pushed with government support, but scientists' through company-funded programs continued to work at the problems associated with superconductive computing devices. These problems, which have increased substantial research effort, include the need for better understanding of superconductivity for sharp transition materials, for the development of suitable superconducting devices, and with the new focus now wound to the more promising film devices, the need to control and understand vacuum evaporation in order to adequately obtain quality superconducting films.

It now appears, the meeting continues, that the promise of cryogenics, and perhaps a few other superconductive

than film devices, will be realized, at least in some form. The anticipated advantages of these devices are:

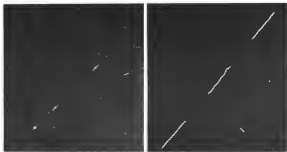
- Low cost
- Extremely small size with very little power dissipation. Packing densities up to 40 million devices per cubic foot was mentioned.
- Ease of fabrication.
- Expected high yields.

Recent Devices

Recent cryogenics, a few of the other devices described as suggested at the symposium were:

- Copley, a switching device used in a simple superconductive device and to be capable of switching from one state to another in 10 nano seconds, was suggested by E. H. Kuper, of the General Electric Research Laboratories, Haddam, Connecticut.

Optimism of this element is based on the outcome of a stationary board



Satellite Photos Clarified

Customer photos in photographs of Russia's first spacecraft launched May 15. It is subjected to a mission of testing (AVN-21, p. 27), now are involved in the work of current mission. Contact is apparent between and handling of rocket war (right) shows by alternate bright dot and faint line ending off, and satellite itself (left). Customers' tracking station outside the satellite pattern in the work of 24 and 25 cycle vibrations from the building on which the camera was mounted, possibly from machinery in the building itself. The 24 cycle vibration now has been eliminated by making the mount, and the 25 cycle has been stopped. One question raised was that both satellite and

rocket are now photographed on the same picture, though at different times. Customers' requests for the building vibrations now have stopped after the satellite passed, thus eliminating the interference pattern in the rocket area picture. Air drafts. Customers felt, were resolved in measuring the pressure length of the satellite by measuring the magnitude of the frequency. First show the vehicle would be 275 ft long. The pattern was not detected in earlier pictures taken by the tower since these photos had not been enlarged. Enlarging the picture showed the vibration pattern was desirable on them with sufficient magnification applied.

AVIATION WEEK, June 4, 1962

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ties between the normal and the superconducting state in a thin film at a specific current level. A hostile element could convert a thin film carrying a standing current which sustains the boundaries. An applied pulse of the same polarity as the standing current is sufficient to push the film into the normal state and hold it there because a current smaller than the film's critical current can maintain the boundary. An opposite polarity excitation pulse can cancel the standing current long enough for the film to become superconducting again.

This work, Wholeness explained, was performed with tin and lead films of 100 to 600 angstrom thickness. Three- and four-element wires made. Their disadvantage: the resistance in the 100 ohms range, disrupted in the CN state. About 10 000 electrons could be employed without serious liquid helium boil off, he estimated.

Macrosawa switches for possible use in ultra-high-speed computers. Experiments which, if successful, could lead to superactive, broadband microwave devices operating up into the K band are in progress at Sperry, Denvers, Co., David Macrosawa told the meeting. Work now under way is attempting to achieve switching in K band (9 kmc).

With van, thin films, targeting in the 100 to 1000 angstroms, Vanos and coworkers derived an equation to determine if the superconductor during film could switch repeatedly at 9 kmc under the influence of a microwave field. The thin film will be used as a probe as a superconductor to control transmission sections. Properly on, the film is used to push a value of the microwave field in the waveguide and has a uniform field across its width. If switching occurs, the coupling of energy into the normal would change suddenly four times a cycle causing substantial second harmonic generation which can be detected.

In earlier work, thin films were used to transmit a current transmission line. In the normal state, the film had the characteristic impedance of the line, in the superconducting state, it shunted the line. Thus required to switch from one state to the other was measured at 0.15 nanoseconds.

The Sperry work was supported by the Navy Bureau at Stennis, as part of what is understood to be a program. Legally, the Navy's large research contract for ultra-high-speed or microwave computers.

Confession sheet superconductivity sensors. A continuous sheet superconducting sensor in which permanent current is used for storage and non-volatile current for detection was described by I. L. Bass at Radio Corp. of America's David Sarnoff Research Center. The sensor employs a contact

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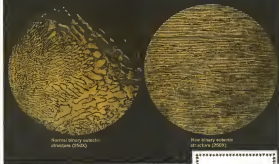
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• **Transistor holders**, TC-500 which are a series of Teflon insulated holders that can accommodate three-lead transistors. Built-in terminals act as heat sinks and permit soldering of transistor in place with less danger of damage to semiconductor. Sylvania Corp., 179 West St., Mount Vernon, N. Y.

• **Servo amplifiers**, solid state devices designed to drive any 11-40 v, constant speed servo motor used in 125 v, 400 cps servo systems is available. Gain adjustable in 7 db steps -15 to 100 dB range. Input impedance of 10,000 ohms can be increased with series resistor. Power output is 3.5 watts into 600 ohm effective resistance. Power gain is 50 db maximum with no feedback or 70 db with feedback. Amplifier weighs 0.67 lb, meets MIL-STD-883B United Control Corp., 4546 Union Bay Road, Seattle 5, Wash.

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variable loads, and current range up to 1.5 amp over entire voltage range. Line regulation is better than 0.1% or 0.2 v, whichever is greater for input voltages from 105 to 125 v. Each model is designed for 75 m. rack mounting. Power Source Inc., Burlington, Mass.

• **Video detector monostable diode**, Type INDA for use in X band and which permits full range of electron count-measured from less than 1000 to 10,000 is contained in one package, is hermetically sealed and has video amplifiers, range of 3 to 17 thousand ohms according to the firm, Sylvania Electronic Products Inc., 230 Sylvan Rd., Woburn, Mass.

• **Chopper stabilized low level d.c. amplifier**, model 779-B can accept 5 microvolts to one volt signals and provides low-drift, low noise, highly stable and good resolution outputs, according to manufacturer. Used in sealed foil laboratory work or for handling thermocouples.



couple strain gauge and resistance type transducer outputs, and sells at \$100-150 complete with cabinet, handle and panel meter. Wheaton's meter, amplifier can be purchased for \$179.50. Mag. name Instruments Co., Thousand, N. Y.



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MISSILE ENGINEERING

Kiwi Tests Produce Nuclear Rocket Data

Washington—General performance goals and requirements for a fission nuclear rocket engine have been generally established following a study of results of the first running of the Kiwi-A experimental nuclear test reactor.

Guided by Atomic Energy Commission, Air Force and National Aeronautics and Space Administration personnel in engineering efforts that can be obtained without further basic research are:

- Test fission nuclear rocket will develop approximately 50,000 to 100,000 lb thrust and have a reactor power of about 3,500 megawatts.
- Specific impulse of the first generation nuclear rocket will be about 600 sec, which requires a maximum mass

pressure of approximately 2,500G. Ultimate specific impulse for a heat exchanger nuclear type rocket is expected to be about 1,700 sec.

• Range of power densities to be expected on heat exchanger type nuclear reactors is 100 to 500 kw per lb. This is well above the power densities of reactors in use today, but the Kiwi-A tests have shown they are practical when the operating life required of a rocket engine is from 5 to 10 min.

• Load base required by the reactor in a nuclear rocket is below needs of the other components of the rocket. The engine purge valves, lines, etc., required for transporting and retaining the liquid hydrogen propellant for instance, have required more development

time than have the actual reactors.

Opinion of the technical people in charge of the Kiwi-A nuclear rocket program is to the feasibility of a nuclear rocket has been made clear in congressional testimony.

Dr. Baruch E. Schriever of the Atomic Energy Commission and technical head of Project Kiwi-A told the Research and Development Subcommittee of the Joint Congressional Committee on Atomic Energy, that the use of heat-exchanger nuclear engines to propel space vehicles appears to be a matter of detailed engineering, minor and a determination to carry the project through.

Tests with the Kiwi-A reactor were completed last summer at Jackson Plains, Nev. Tests were successfully completed during the first high temperature operations of the reactor. Purpose of the Kiwi-A test was to operate the reactor at high power and to build a production scale prototype for a period representative of an operational cycle for a nuclear engine in space.

Additional Tests Planned

Several short experiments were made before the high power run to check the coolant system instrumentation, controls and characteristics.

On the basis of the first successful running, AEC plans to test two more reactors this summer in Nevada. These are designated Kiwi-A prime reactor and will resemble the original Kiwi-A except for minor changes shown to be desirable in recent testing. Main objective of the Kiwi-A prime tests is to provide some concrete evidence as to the operating life of the reactor and its behavior in operating times and some possible damage occurs.

Dr. Schriever, in explaining Project Kiwi-A progress to the congressional committee, said the "limited effort" authorized had been applied primarily to the development of reactors. Multiple sources of reactor design were generally ruled out because of funding problems and that was the reason for the optimism of AEC personnel when Kiwi-A their one-shot research step toward a fission reactor, performed as well under test.

First detailed description of the Kiwi-A reactor and test setup was recently made in Air Force Lt. Col. Howard R. Schmidt and Maj. Ralph S. Bender who are attached to the AEC's Project Kiwi-A.

The reactor weighed more than the

thrust it could produce. A number of compromises were made in the reactor design to keep it simple and to lower cost. Separate circulating water systems were provided for the primary and secondary. This avoided the development of sophisticated coolant systems for the "combustion chamber" and the auxiliary liquid hydrogen propellant for the reactor. Some heavy water moderation was used in the reactor to minimize fuel volume, mass and propellant flow rate. Externally, simplifications to the test reactor resulted in a large network of pipes that would not be necessary on a flight engine.

Test Process

The Kiwi-A test facility is a complex of many systems and based upon the success of this experiment it is probable that most, if not all, nuclear rocket testing will be conducted in this pattern. Chemical systems are usually tested with the nuclear drive to prevent the collection of high temperature vapors or liquids in the combustion chamber and the formation of explosive mixtures. Nonleaking test attitude chambers for use for large test tanks and coherent de-fission systems.

During the test, the Kiwi-A reactor set-up as a beehive structure on top of a subsoil core that was physically attached to a test cell building. The building housed the control and drive mechanism and the instrument house for several hundred instrumentation channels. Cooling water and propellant was taken aboard the subsoil core through lines connected to tanks in the test cell building area.

Project personnel were housed in a control building two miles from the test cell. Hydrogen propellant flow was initiated before the reactor began producing power, and it was helpful to have a backup tank. No attempt was made to shield the reactor or to contain fission products other than the reactor is there in the propellant system are activated when the wind comes from the control building, but the two-mile spacing is sufficient to prevent any damage to personnel if the wind suddenly changes.

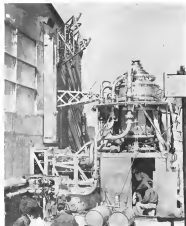
Minor damage of fission products during the Kiwi-A test occurred about a mile from the reactor. They were generally mild because, had a person been standing at that point would be, he would have received no more than a one-pink, unnoticeable occupational level from all of the fallout effects.

Many elaborate measurements were made and aircraft were flown through the exhaust plume from the reactor. These tests and measurements indicated that operation of much larger power can be safely tested at the Jackson Plains facilities.

The Kiwi-A reactor was transported



ENGINE house JARO bottle runs during last Kiwi-A test at Jackson Plains, Nev. Below, control mechanism for reactor power level is serviced in Kiwi-A plant.



Kiwi-A, G-1 Project Kiwi-A experimental nuclear reactor, mounted on specially-controlled railway car, is coupled to test cell prior to an experimental run.



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from its test cell building to a maintenance and conversion building about two weeks after the test. The Executive said to make the transfer was shocked, and the dismantling and checking of the reactor parts was performed separately in a shielded box.

French Nuclear Plans Decried by General

Paris—French Gen. Jean Valley, who retired from active service last month, said France should drop its ambition to create a national nuclear strike force and rely instead on integrating its forces with the European allies.

Gen. Valley, who since 1956 has been chief commander, Allied Forces, Central Europe, does not agree with Gen. de Gaulle's plans to set up a national strike force based on Dassault Mirage IV aircraft or E2Ms.

Composition of such a force, Valley said in Paris, requires considerable numbers of high-trained personnel which France, as well as Great Britain, can barely meet. Such force also requires an industrial and research setup which would strain French resources. Noting that the British recently dropped their Blue Streak missile project, Valley recommended that his country scrap its strike force project as well.

"There is no doubt," Valley said, "that to create such a force requires cooperation between European nations." Valley also characterized some of French military equipment as "obsolete and worn-out." French arms, largely engaged in Algeria fighting, would be completely devoid of experience when it finally enters North Africa, Valley said.

Turning to NATO nuclear problems, Valley, who has a reputation as an intellectual, "unwashed" general, said it was highly unlikely NATO Central European forces could stop a Soviet thrust across Central Europe. Russia, he said, has 24 divisions ready to move in East Germany, with another 10 divisions capable of moving into the area. Within 10 days of initial attack, Soviet troops could mobilize 60 divisions. To hold the Central European line against a force this size, NATO needs at least 45 divisions. Yet, Valley said, NATO Central European forces have far below the established goal of 30 divisions.

On use of tactical nuclear weapons to offset the Soviet advantage, Valley, declared that such weapons would come into play only in the attack. He stated that as NATO commander, including Gen. Erwin Nordt, Supreme Allied Commander, Europe, could order use of such weapons against a conventional Soviet attack without prior political decision. To get such a decision, Valley said, each of the 15 NATO nations would have to be consulted.

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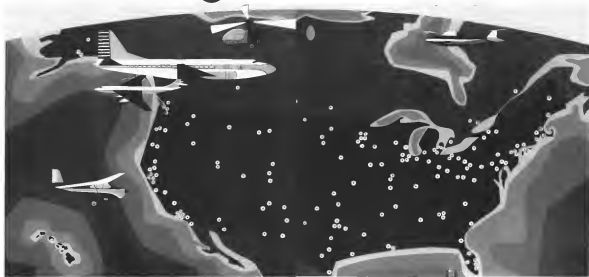
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Highways or Skyways... ESSO RESEARCH works wonders with oil.

Chance Vought Tests Field Missile Design

By Richard Sweney

Los Angeles—A solid propellant missile suitable for short and long range combat, with direct support systems, which has a single control system for guidance, launch and after thrust termination, has been developed by Chance Vought Aircraft Inc.

The missile incorporates a complex set of low aspect ratio fins attached to the outside of the solid rocket motor case. Guiding the entire motor during burning provides direct vector control during that tight period, while aerodynamic forces on the fins during flight after burnout are sufficient to maintain control to the longest range of the missile. It was revealed at the American Rocket Society symposium meeting here by the company's R. J. Block, Jr., and J. C. McCracken.

System advantages, according to Chance Vought, include use of a single stage launcher. Coupled with the simplicity of a solid propellant engine, field operations become very flexible and in active time is short.

Missile configuration was based on combat use data support system requirements. Maximum diameter is 12 in., total length 145.5 in., gross weight 510 lb. Maximum design range is 12 mi. and maximum range is 1,000 ft. Missile is built in two basic sub-fused sections and rocket motor section. A forward port contains the rocket motor to the aftmost proper, with two hydraulic actuator linkages providing deflection of the entire motor. One guidance and control system is used for both powered and unpowered flight. Rocket motor deflection provides yaw and pitch control, while the two hydraulically-actuated fins mounted near the midpoint of the rocket give the constant roll attitude which is used to prevent over-rotation in yaw and pitch axes.

Two displacement function systems provide attitude reference, one for pitch, the other for yaw and roll. Both are powered by d.c. motors. Two rate gyro, also d.c. motor-driven, provide yaw damping in pitch and yaw axes.

Missile usage is controlled by a pitch programmer which is set before launch, and causes the missile to deviate to the ground at the proper time during flight. Electric control valves on the actuator respond to signals from the guidance system signals. All thrust vector power from rocket case means roll.

Rocket motor case design and manufacturing was performed by Chance Vought, with Autromatic launching system contract as propellant grain design, con-

ducting development tests and assembling flight test motor.

Original motor parameters were changed during the program, and flight test motors were used which had an average chamber pressure of 910 psi, a throat of 1,278 lb. at 70°, and total impulse of 19,660 lb.-sec. Motor case used 17-7 PH stainless steel, heat-treated and aged to 168,000 psi yield.

Agons were welded center section is closed at the front by a conical head. Structural weight is centered in the design to get the motor center of gravity a minimum distance from the exit nozzle joint. All clearance is conventional, except, with nozzle of 30 deg. nose angle and expansion ratio of 3.08. Nozzle internal surfaces are coated with chromite layers of Anelco A and red-brown.

Costable Formulation

The propellant is a suitable formulation of polybutadiene fuel and oxidizer, using perchlorate oxidizer, chosen for its immediate availability rather than for particular properties or characteristics.

A waste flight-test program was established to prove feasibility of the overall concept rather than specific characteristics. Tests were conducted on a Redstone Arsenal range 24,000 ft.

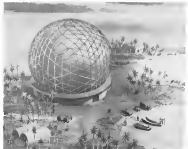
long, and motor casing and motor case exit extrusion used in the test flights which were made.

- **Missile No. 1**—As a far ranging distance.
- **Missile No. 2**—As a far ranging distance.
- **Missile No. 3**—As a far ranging distance.
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Flight of first missile resulted in satisfactory launch, guidance and terminal phase, except that a distance of 400 ft. was selected which programmer setting had been based on a desired distance of about 16,500 ft.

The second missile represented an eight modifications—after launch a programmer to the motor guidance control which was followed immediately by a large speed deflection of the motor. The missile performed a violent loop and was destroyed by command destruct.

Flight missile number three had a modified pitch programmer and was set for a distance of about 15,700 ft.,



Nike Zeus Electronic Devices Housed in Radome

United States Army Nike Zeus anti-missile missile system radome, to be tested on the Nike Zeus in South Pacific, shows rehearsal system before being moved to the main command. Some parts of the Nike Zeus will be placed between the main command and the rehearsal system before being moved and then completed guidance system before being moved.



A.W. Haydon interrupter timer

Western Electric Call Director telephone

Correct wiring connections made twice as fast!

2 Flexprint® Cables replace 22 wires in A.W. Haydon's interrupter timer...

In one of Western Electric's conventional unattended office telephone systems — utilized by both the familiar push-button control telephones and the existing new Call Director telephones (shown). The multi-function interrupter timer performs 12 automatic performing functions within the Western Electric system.

The A.W. Haydon Co., Watbury, Conn., switched from conventional wires to FLEXPRINT cables to speed up accurate location of connections and simplify soldering of 44 terminals. Result: wiring time cut in half.

Total cost of wiring can be cut as much as 50% when FLEXPRINT circuits replace conventional wiring in electrical and electronic assemblies. Let's see how. Richel and qualified to match your exact requirements, these fast, flexible circuits come in one piece, ready for immediate attachment. No selection of color-coded wires... no cutting to length... no harnesses to lace. Conductors and terminations are accurately positioned for high-speed soldering techniques. 100% reproducibility results in consistently uniform wired assemblies. Costs of quality control testing, trouble-shooting and rework are reduced.

New design engineers' digest describes how FLEXPRINT wiring also fits wire production equipment and mislabeling problems... shows actual Flexprint circuits now in use... suggests new applications... tells you how easy it is to get started with these modern flexible printed circuits. Write for copy!



FINANCIAL

Ling-Temco Merger Appears Assured

Dallas, Tex.—Stockholders approval of a merger of Ling-Altec Electronics, Inc., and Temco Aircraft Corp., is probable June 30 when shareholders of both companies vote on the proposition, top officials of the companies indicated here last week.

Ling-Altec board chairman and chief executive James J. Ling and Temco president Robert McCulloch said that they already have received favorable reaction to the merger plan from major shareholders.

There had been some unrest among Ling-Altec major shareholders over the recently proposed executive management lineup, under which James Ling was to be vice chairman of the board and chairman of the executive committee and Temco executive vice president-general manager Chas. Sierra designated as president of the new company.

These differences apparently have been resolved by designating Ling president and chairman of the executive committee and Sierra the executive vice president-general manager. Ling-Altec executive vice president-systems manager Lee D. Webster, who had been proposed in Ling-Temco executive vice president, would be designated vice president-systems manager of the new firm.

Also altered was the stock exchange list, originally one-third of Ling-Temco for one-third of Ling-Altec and two-thirds of Ling-Temco for one-third of Ling-Altec. New Temco shareholders will receive 46/100 of a share of common and 17/100 of a share of a special convertible preferred stock for each share of Temco.

Intersecting business lines with large Ling holdings were mentioned in the changes, but now are reported to be supporting the merger. Temco president McCulloch, who had earlier been proposed as board chairman of Ling-Temco Electronics, retains his title.

Ling-Altec board of directors having voting proposals to be proposed to stockholders, provides for a 10-man panel with one member from each company. Ling-Altec are James J. Ling, Lee D. Webster, Dr. V. A. Davidson, Paul Hallagren, Jr., Alvin A. Wood and James O. Weldon. Temco are McCulloch, Sierra, D. R. Byrd, James Gorman, Harold Wolf, and O. Ray Moore.

Advisors, unavowedly discussed proposed as D. C. Holman, R. C. Lohr, Chas. J. Purcell, Frank D. Rose and

O. G. Willard, Jr., of Ling-Altec and H. N. Malton and H. L. Howard of Temco.

Under the merger, Temco Aircraft would be converted Temco Electronics & Machine Co., having four divisions—Mechanics and Aircraft, Overhaul and Servicing, Electronics and Industrial. Also under the new lineup, which would be headed by Ling-Temco Electronics, Inc., would be the principal Ling operating companies—Continental Electronics Manufacturing Co., Dallas, Texas; Temco, Dallas; Ling Electronics Division, Anaheim, Calif.; Ling-Altec Research Division, Anaheim; Alter Learning Corp., Anaheim; Portland Electronics Products Division, Los Angeles; Coldwell Co., Inc., San Diego, Calif.; United Electronics Co., Newark, N. J.; and Universal Loudspeakers, Inc., White Plains, N. Y.

Ling-Temco properties will be aimed at breaking the aerospace and largest possible normal electronics negotiation, with considerable concentration on space communications which James Ling feels is put in its infancy and other considerable market potential Ling feels there much work being done at Lincoln Laboratory, Bedford, Mass., an super-high power transmitting equipment opens a new area of product potential for the electronics industry.

Ling-Altec also has developed some equipment in this field, such as super-power transmitters for Voice of America and Navy's long-range, sea-air-ground communications system. They are also heavy and other work being done in the field of radio signals of Temco.

At the time of the merger, the new company is expected to place just behind Litton Industries in business volume, Ling noted, although long-range plans are to develop Ling-Temco as a top volume in electronics. Latest sales volume for the first nine months of the year ending Apr. 30 totaled \$14,498,000. Net earnings were \$5,411,000.

Finding it that the combination of Ling-Altec and Temco Electronics assets, development and production will make possible a major step in building growth of both organizations, since the combination will merge product of talent and other capabilities, making possible integration of present products into systems now readily available, thus possible advantage. One instance noted, for example, is Temco's involvement in digital and Ling-Altec's experience with super-power tube and microwave sections, which would provide the basis

for systems required in future space operations.

Combination will also develop a strong research and manufacturing team more capable of handling large projects as either a systems manager or as a team member in a joint venture.

Further advantages of electronics potential apparently will be made to 60 in any type in the organization.

Ling and Temco feel that the merger will provide the new company with at least two main jump in capability over what either firm could have achieved working by itself, and the increased potential and working capital will also make possible a faster rate of growth than either could achieve separately. It was indicated that Temco is coming into the new organization with some 340 million in yet-unannounced electronics research and development business that will benefit greatly under the merger. Indications are that the merger will also provide Ling-Altec with considerable Temco production capability that it will find useful.

Vickers 1959 Sales, Earnings Show Drop

London—Annual report of Vickers, Ltd., for 1959 shows lower turnover, a depleted order book and smaller profits than the previous year. The Annual Report—now parent of the British Aircraft Corp., Ltd., one of the two main aircraft manufacturers responsible for the fall in both sales and net orders.

Group sales fell by \$64.4 million to \$131 million, of which aircraft provided only \$115 million against the 1958 figure of \$182 million. Total orders on hand at year-end stood at \$790 million compared with a 1958 figure of \$574 million, and group profits before taxation were \$25.7 million, \$10.8 million less than in 1958.

Points from the report:

- Work on the TSR1 turbojet strike-reconnaissance aircraft has now reached the detail design stage. It is expected to be "admirably consistent to Government requirements."
- Ministry of Supply contract for a design study of variable geometry aircraft on the lines of the famous Vickers-Southern "Inflexible combat." First phase of this work is nearly done, but "since we are a number of studies still to be completed before it is possible to assess whether the application of variable geometry would be advantageous."

JUNE 20, 1960 Aviation Week



ARTIST'S CONCEPTION
SABOTEUR MAY BEAT
AIR UNDETECTED BALLISTIC MISSILE

SAC IN TRANSITION

The changing role of the Strategic Air Command in the national defense picture will be featured on June 20th in a special 36-page report prepared by AVIATION WEEK editors with on-the-spot coverage of the SAC Command—The nation's shield against aggression.

This exclusive report will be published in answer to the growing requirement for an improved national understanding of SAC's changing role as the primary deterrent force guarding national security. The special EAD issue will be devoted to this message which is today's most challenging subject.

The Strategic Air Command's deterrent position has undergone complex and fundamental changes in its transition to a Strategic Aero-Space Command—with its formidable bomber fleet soon to be reinforced by intercontinental ballistic missiles operationally deployed to instantly counter any aggressive action.

The transition of SAC is one of the most rapid and exciting events in the history of our nation and its defense. What SAC needs, what has changed and the weapon systems to be employed in the immediate future will be key subjects included in this first-time technical evaluation. The impact of new technologies and weapon systems has changed the entire defense concept and the response of SAC to these new requirements has been effective and positive.

AVIATION WEEK editorial teams are now engaged in the compilation of the new SAC story—one that will generate world-wide readership. This issue, "SAC In Transition," offers manufacturers and suppliers of the aerospace industry an unusual opportunity to advertise and identify their role in the national defense effort.

Aviation Week
and Space Technology

A McGraw-Hill Publication • 350 West 42nd Street, New York 36, N. Y.





**they hatched this bird in record time
where the sun shines all year long**

Less than two years after the Army contract was announced, Martin's Pompano plants reared off its pad to pass its first flight test. The project was right on schedule.

Three existing pom "shoot-and-coast" added payload capacity over new up on its own all-terrain carrier or by surplus. It destroys major targets over a wide selective range.

Advanced Weapons Systems like Pompano are developed in Martin-Oltford's climate of achievement.

It's a "climate" that nurtures imagination, curiosity and determination—qualities that turn out missiles like Ballpop and Lacrosse, and electronic achievements like this Missile Master air defense control system.

Combine 18 months a year sun, shore living in Florida with career success. Join an organization that has continuously led the way in the development and production of major missiles and electronic systems. Write to C. H. Long, Director

of Employment, The Martin Company, Orlando 9, Florida.

CURRENT OPENINGS for engineers in these areas: ground and airborne electronics • advance design • systems • aerodynamics • quality and test • reliability • electronics manufacturing . . .

WORK IN THE CLIMATE OF ACHIEVEMENT

MARTIN
ORLANDO

New Offerings

Hannabarger Corp., Milwaukee, Wis., engaged presently in the repair, overhaul and sale of a diversified line of heavy machinery and equipment. Of being a 60,000 shares of convertible preferred stock, \$100 per share, for public sale, dividend rate, offering price and underwriting terms to be applied in accordance. Proceeds will be applied to the repayment of a portion of the company's short-term bank borrowings. A previous offering last year was withdrawn because of unfavorable market action.

The Garrett Corp., Los Angeles, Calif., engaged presently in research, development, engineering and manufacturing of specialized parts, components and systems for aircraft and missiles together with related ground support equipment. Offering a 100,000 shares of common stock for public sale, offering price and underwriting terms to be applied by arrangement. Proceeds, together with \$12,000,000 to be borrowed from various companies under a long term loan agreement, will be used to pay indebtedness consisting of \$15,000,000 of short term notes, \$2,121,428 of long term notes, a \$300,770 long term note issued in connection with the acquisition of certain subsidiaries.

Selma, Inc., Stamford, Conn., organized under Delaware law in March, 1960, for the purpose of acquiring 100% of the outstanding stock of Selma, Inc., a Connecticut corporation, organized in April, 1958, by the present principal stockholders of the Delaware company, to develop and manufacture telecommunications equipment for commercial and military markets and test applications. At present, which is jointly divided between engineering and production operations, products include pocket size modems and computer type equipment necessary for high speed data transmission systems. Offering is 171,000 outstanding shares of common stock for public sale in the hidden, third offering will be made on a best effort, all in same lots.

Apco Electronics, Inc., New York, N. Y., organized under Delaware law in February, 1960, as successor to a New York corporation of the same name which commenced business in 1945. The company and its subsidiaries are engaged in the manufacture and sale of computers and related products. Offering is 140,000 shares of Class A common stock for public sale, offering price and underwriting terms to be applied by arrangement. Of the proceeds, \$50,000 will be used for completion of the company's advertising

and merchandising activities. \$35,000 for research and development. \$125,000 for expansion and improvement of the company's physical plants and equipment. \$150,000 to carry additional activities for production and additions to its product lines the balance for working capital.

Edgerton, Germann & Green, Inc., Boston, Mass., engaged in the design, production and application of electronic and machine instruments. The company is a great contractor to the Atomic Energy Commission and the company has participated in other scientific research and development projects in electronics for other agencies and private industry; it has developed and is expanding its own line of commercial products and components, specializing in the design and production of instruments and components for the control and measurement of ultra high speed phenomena. Offering is 125,000 shares of common stock, 100,000 shares to be offered by the company and 25,000 outstanding shares by the hidden, third offering price and underwriting terms to be applied by arrangement. Of the proceeds, \$300,000 will be used in connection with the purchase of new additional equipment and the replacement of certain shares of equipment now furnished



The B. F. Goodrich Pressure Indicator incorporates an O-ring design feature, which allows a pressure which pressure needed a point value in the range of 250 to 300 p.s.i. Above is less than 1 inch long, weighs under half an ounce. Now used in primary master batteries and remote batteries, special design can be built to meet your needs. Write for complete information.

B.F. Goodrich
aviation products

Dep. 477-14, Akron, Ohio

PROBLEMATICAL RECREATIONS 17

Mary Ann Moore a father has a yacht and to his neck of the four friends: Colonel Downing, Mr. Hall, Sir Bernard Hood, and Dr. Parker. Each of the five has his own daughter and each has named his yacht after a daughter of one of the others. Sir Bernard's yacht is the *Collette*, Mr. Moore owns the *Louisa*, Mr. Hall the *Resolute*, the *Melissa*, owned by Colonel Downing, is named after Sir Bernard's daughter. Collette's father owns the yacht which is named after Dr. Parker's daughter. Who is Laura's father?

—Answer: Sir Bernard



Inquiries concerning solutions (solution pits) load compressed pits, and pits with special mechanical configurations should go to our Problematic Recreations, Mr. Vernon, New York State Inc.

ANSWER TO LAST WEEK'S PROBLEM: One cut in the third link will allow two links to be swapped for a knot and a link on the second connection, and 3 links for a knot and 2 links on the third and so on.

LITTON INDUSTRIES
Beatty Hills, California

INFORMATION PROCESSING

Information Processing plays a vital role in the Lockheed Missile and Space Division's activities—from aiding basic research and development to improving current efforts and conceptual projects. The Division's computing facilities are among the most advanced in the country and include: two—IBM 7090; two—Seymour 1103 AF; one—Control Data Corp. 1604, in addition to a variety of other advanced peripheral equipment. Future plans include several IBM 1481 Data Processors.

Functions of Information Processing encompass: Preparing programs and operating logic, high-speed digital computers, responsibility for the Division's analog computing activities—including set-up and operation of analog computers, used both in simulations and in solving problems; the reduction of highly complex and critical telemetry data received from missiles and space vehicles.

Further activities involve performance data reduction for Quality Assurance and Manufacturing, and programming of Administrative Data Processing and Financial Processing Problems for the entire Division.

Expanding the scope and depth of present programs in Information Processing has created positions for engineers and scientists with experience in these important areas.

DIGITAL COMPUTER SYSTEMS DEVELOPMENT including monitors, computers and information retrieval systems.

HIGH-SPEED DIGITAL COMPUTER PROGRAMMING for missile control, scientific computation, numerical analysis, and administrative data processing.

TRAINING PROGRAMS conducted for computer programmers and operators.

ANALOG COMPUTER OPERATION in solving complicated engineering problems.

AUTOMATIC CONVERSION of flight data and wind-tunnel information into analog and digital converters and advanced automatic control devices.

FLIGHT DATA AND SYSTEMS ANALYSIS including research in complex problems, theories and methods of preflight and flight data analysis, test performance research, analysis and performance reports on testing flight test data and data reduction.

DATA PROCESSING EQUIPMENT DESIGN including research and engineering in development of highly advanced data conversion devices.

Engineers and Scientists. Work in the broad spectrum of Information Processing functions provides constant challenge at Lockheed's Missile and Space Division. If you are experienced in the above areas, you are invited to write Research and Development Staff, Dept. T-17A, 962 W. El Camino Real, Sunnyvale, California, to be considered for current Department of Defense material security clearance required.

Lockheed

MISSILES AND SPACE DIVISION

Engineers Manager for the New POLARIS Film: the Air Force AGES is available in the DISCOVERER MOVIE and SAMOS Programs. Air Force N-3 and Army KINGFISHER.

SUNNYVALE, CALIF. ALTO, SAN JUAN, SANTA CRUZ, SANTA BARBARA, CALIFORNIA • SEAFORD, FLORIDA, ALAMOGORDO, NEW MEXICO • HAWAII

by the government \$200,000 will be used to increase, in preference, the balance will be added to the company's general funds and used to meet design, development and other costs in connection with the introduction of new products and the expansion of present product lines and for other corporate purposes.

McConnell Selph Associates, Inc., Holliston, Calif., engaged in research and development work and the main business and sale of various products in the field of explosive substances. Offering a 150,000 shares of capital stock, 100,000 shares to be offered for public sale in the coming company, and 10,000 outstanding shares to be held in place of. Offering price and underwriting terms to be applied by amendment. Of the proceeds, \$185,000 will be used to increase existing indebtedness to a bank, \$50,000 to reduce, suppliers' accounts payable. Balance will be added to general funds and will be used primarily to carry larger inventories and trade receivables.

Laboratory for Electronics, Inc., Boston, Mass., engaged in research and development and production of electronic equipment for marine and other applications. Offering a 150,000 shares of common stock at \$1.00 per share, to be offered in two tranches. The first tranche to comprise stockholders' offering price, subscription rate, record date and underwriting terms to be applied by amendment. The company estimates that it needs \$2,300,000 at the time, and is expected to finance the remainder of its business in the present state, and to finance expansion. No proceeds not needed for such purposes will be used to reduce bank loans.

Isoson, Inc., Port Washington, N.Y., engaged in the manufacture of environmental test equipment which simulates the temperature, humidity and pressure conditions found on or near the earth's surface, in the stratosphere, and in the space beyond. Offering is 250,000 shares of common stock, for public sale at \$1.00 per share, the company estimates have made a firm commitment to purchase 60,000 shares and 240,000 shares are to be offered on a best efforts "all or nothing" basis. Of the proceeds, \$60,000 will be used for the repayment of certain current or indebtedness including trade payables and \$18,000 for the acquisition of certain current liabilities guaranteed by corporate officials and stockholders. If the 140,000 shares are sold, the proceeds will be used for instrumentation and maintenance of laboratory equipment, expansion of existing manufacturing facilities and the acquisition or construction of additional facilities, replacement of certain indebtedness

capital (to be guaranteed by certain directors and stockholders, the balance for working capital).

Acquisitions And Mergers

Aeris, Inc., of Waukegan, N.Y. produced Colvia Laboratories Inc. and Precision Elements Inc. both of East Chicago, N.Y. for 10,000 shares of Aeris Inc. A capital stock Colvia produces electrochemical instrumentation. Precision Elements produces precision optics for telescopes. Aeris designs and makes instrumentation for automatic control and flow measurement, automatic checkout and analysis systems.

Technology Instrument Corp. of Andover, Mass., has acquired the electro-magnetic clutch and brake product line of Hamilton Manufacturing Co. Operations of Hamilton will be consolidated with TIC's work in making transfer into components.

Telecommunications Corp., Los Angeles has purchased for an undisclosed cash amount the proceeds acquired 15% of Frank R. Cook Co. Telecommunications' Denver subsidiary which designs, develops and manufactures high-speed electronic circuits for modern power sources in radar.

Dover, Inc., Smyrna, N.Y., purchased American, Inc., computer data solutions. Dover produces computer components.

Cassidy Co. of America's subsidiaries Solid State Electronic Controls Inc., Longview, Tex., has been merged with the parent company and will become the Electronic Division, continuing to develop and manufacture semiconductor devices and systems in micro and control applications.

Rothman Co. has agreed to purchase Garbus Engineering Co., San Francisco and will operate the acquisition as a facility of Rothman's Marine Products Division. Garbus manufactures electronic, electro-mechanical and instrumentation devices.

Chandler Beam Corp., producer of fuel control systems and accessories for aircraft and rockets, has purchased major assets of Lamson & Goodrich Manufacturing Corp., Farmington, Conn. A research and development firm specializing in hydraulic, pneumatic and electronic

Katharine Optical Corp., Northampton, Mass., and Inland Motor Corp., manufacturer of torque actuators for aircraft propulsion, have merged through an exchange of stock.



FLIGHT TEST ENGINEERS

Versatile, practical-minded engineers with a record of accomplishment in the missile, aircraft or related fields will now qualify for a flight test position at Convair/Astronautics—engineers and testers of the mighty Atlas ICBM. Positions exist in kind immediately at various locations from Cape Canaveral, Florida, to Vandenberg AFB near San Marcos, California. Opportunities exist in: Propulsion • Hydrodynamics • Performance • Riverline Transfer Systems • Missile Structures • Aeroplots and Guidance • Launch Control Systems • Electrical Power • R & F Systems • Telemetering • Landlines • Ground Support Equipment • Closed Loop TV Systems • Data Analysis.

Write now to Mr. R. D. Marvin, Engineering Personnel Administrator, Department 130-93, 3506 Kenny Walk, Redondo Beach, California.



CONVAIR/ASTRONAUTICS
CONVAIR DIVISION OF
GENERAL DYNAMICS

Industry Officials' Compensation Listed With SEC for Last Year

Washington—Following is a list of reported industry officials and their base salaries, bonuses and stock holdings for 1978 as filed with the Securities and Exchange Commission.

General Electric Co. President Robert W. Colwell, 67, received \$27,100 salary and 180 shares of stock. J. E. B. Bland, 61, president emeritus, received \$20,000 salary and 100 shares of stock. R. W. Bland, 61, vice president, received \$19,000 salary and 100 shares of common stock.

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- MOBILE & SATELLITE COMPUTERS & SPACE
- TELETYPE COMMUNICATIONS & UNCLASSIFIED
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Facts about the tests

- 1 Each technical test is composed of 40 multiple choice questions.
- 2 To find answers for some questions, information is required—but easy to find & give accuracy associated with the work.
- 3 The "index" of questions is chosen from a pool of 100 questions, some based on the date of the test.
- 4 Name of test engineers achieved a perfect score.
- 5 The test for Engineering Ad aptness is a psychological test designed to reveal aptitudes and abilities most often found in good engineering engineers or administrators.

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WHO'S WHERE

(Continued from page 27)

Changes

Larsson: *Psychic, director general development, Union Pacific, Denver, Colo. N.Y. N.Y.*

Mohr: *J. German, director Customer Relations Division, Franklin Institute, Division of Electrical Engine & Appliance Corp., Westchester, N.Y.*

John: *Albert, director government relations, Aerofin Development Co., Pasadena, Calif.*

Hart: *E. Wilson, chief of equipment and safety research section, GE Systems Division of Douglas Aircraft Co., El Segundo, Calif.*

Alfred: *Deussen of General Motors Indianapolis, Ind., announced the following changes in the Aircraft Engine Operations: William D. Wilson, technical assistant in operations manager, GE Motors, Westinghouse and contracts; William E. Cooke, assistant manager of manufacturing.*

Edward: *J. Rind, senior vice president, General Systems Corp., Hughes Aircraft Co., Palmdale, Calif. Other changes: Charles E. Decker, controller for product line operations; William E. Haggren, manager of product line operations; John M. Teller, manager of the year computer and parts service division; David D. Weaver, manager of selected divisions; Joe M. Teller, manager of the year computer and parts service division.*

Robert: *L. Walsh, manager of staff and planning, Aerospace Division of North American Aviation, Inc., Downers, Calif.*

A. S. Gresham: *manager of Vehicle and Production Division of General Motors Corp., Warren, Mich., Calif.*

Ted: *Deussen, Jr., manager of the new product administration, Aerospace Division, a Division of General Motors Corp., Warren, Mich.*

Bern: *E. Vane, chief computer applications section, Systems Division of Rockwell International, Inc., Torrance, Calif.*

John: *E. Cahn, manager, Trip Division, Division of American Rockwell Corp., Philadelphia, Pa.*

Dr. Richard: *W. Solari, technical staff of research and development, General Systems Corporation, Mountain View, Calif.*

J. R. Walsh: *manager of Electronic Tube Division of Sperry Gyroscope Co., Great Neck, N.Y.*

James: *R. Corcoran, Jr., reported assistant to the vice president of Operations of The Westinghouse Corp., Dayton, Ohio.*

Capt. G. F. Wells: *manager of flight operations North Central Airlines, Minneapolis, Minn.*

Geoffrey: *Bullard, chief of aircraft design, Propulsion Division of California Institute of Technology Jet Propulsion Laboratory.*

Other appointments: Robert F. Bass, deputy chief, Douglas E. Burt, chief of the Liquid Propulsion Research Section, Launch & Payload, chief of the Solid Propellant Research Section.

Arthur: *Engels, Jr., chief of the Liquid Propulsion Development Section, Dr. Robert F. Ransel, chief of the Solid Propellant Research Section and John A. Frosch, chief of the Advanced Propulsion Section.*

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